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THE ARROW*

BY FRANK HAMILTON CUSHING

I

ITS ANTIQUITY

One of the most ancient of the things men have made is the arrow. There is no weapon the lineage of which can be unbrokenly traced further or to a simpler beginning. We have been apt to lose sight of this through associating as inseparable, alike in origin and use, the *bow* with the arrow. But I think it can be shown that the arrow had been perfected in well nigh all its parts, had attained rank as the chief weapon and one of the supremest possessions of man, and had given rise to a surprising variety of things and uses long ere the simplest bow had been conceived of or fashioned.

If this be true, then the arrow in its ancestral or embryonic form at least, was as old as either the stone axe or the shaped knife of flint, if not older; was, in fact, coeval with the knotted clubs and rough stones men picked up at need in the wilds they earliest traversed; and we can see that through javelin and dart and harpoon it was sprung from the spear and lance, as they from the fire-sharpened pike, and this from the mere pointed stick—made sharp not by art, but by use—for digging or hurling, by turns.

* Vice-Presidential address before Section H of the American Association for the Advancement of Science, read at Springfield meeting, August 29, 1895.

II

ITS INFLUENCE

Again, there is no weapon and no single thing that for ages held sway so potent over the minds or the destinies of men, or wrought more varied influence over their institutions and customs than did the arrow; for I think I can also make clear the fact that as it was the chief reliance and resource of primitive man in the two main activities of his life, war and the chase, it speedily became his first, and ever remained, by representation at least, his highest, instrumentality for divining the fate or fortune its use so often decided, and in this way came to affect as no other single object of art ever did, the development and history of mankind in general the wide world over.

There is far more basis, then, than mere romance and beauty of comparison, for the poetic meaning of the arrow of literature, from Biblical and classic allusions, to Shakespeare's own. "Jove's thunder-bolts" or "Cupid's darts," "Diana's arrows" or the "shining shafts" of Apollo, or of "Death" and "Destiny," were real arrows to the men of old time, for to them the love pang was an actual wound from a random and puny childish shot. The sharp pain of mortal throe or the slow anguish of fleshly ill was from a veritable stroke of the cold, breath-sent shaft of ghostly foeman, or was the ceaseless rankling of some venomed barb of envious wizard or gaunt hungering demon.* The fire streak of the skies, the bright rays of the sun, the stinging flight of the sand-blast or hail-storm, and the sudden frost-bite—all of these were, indeed, to them the very counterparts and relatives of their own man-made but magically fashioned and feathered missiles. "Straight," "true," or "quick" as "an arrow," "sure as a shot," meant more to them than to us, for the force of such phrases never wore out so long as archers held their sway and men spake, like Homer's heroes, with "winged words."

* Thus the Zuñi name for a swelling is sho'lina (from *sho'ole*, an arrow, and *i'na*, the content, the innermost element, quality, substance, or cause of a thing), and literally rendered means "arrow in it" or "arrow-caused." Thus, too, rheumatism is called by the Zuñis the "*sholiwe evil*" or "*disease of arrows*;" and in treating this malady their medicine men try, after due manipulation of the affected part, to pluck forth the misty arrows or barbs they suppose are within, with magical snare-wands of eagle-feathers, blowing lustily the while to cast out these poison-missiles and thus keep them from harming others or themselves.

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III

ITS RELATION TO ANTHROPOLOGY

In presenting to you, then, a study of the arrow, I am not departing so far as might seem from the requirements of the high office you have so kindly called upon me to serve, for I would offer something characteristic, not so much of a field, as of a method and standpoint of investigation which I believe to be peculiarly adapted to the needs of our science; and I would illustrate, and hope I can measurably demonstrate herein, how special lines may and should be followed to general, and as far as can be, to universally applicable conclusions, these tendered not dogmatically, but suggestively; that we may select, say, single phases and arts of humanity and even local manifestations of them, and should not only present, but study them, subjectively rather than objectively; not externally and categorically or as isolated phenomena, or as mere examples of racial similarities and dissimilarities, nor yet, primarily, even as to whence they came ethnically, but rather, as to how and why they became at all, and originally,—as illustrations, that is, of the laws and principles which have governed man's development under all sorts of circumstances and in every age and land.

It is in this spirit, at least, that I treat of the arrow; not as a weapon merely, not descriptively to any greater than needful extent, but in its relation to the history of man and his culture-growth; as an illustration equal to any, I believe, of how certain few human things and activities have been born (often so simply as to have been inevitable wheresoever man chanced to dwell), and of how they have grown, also very naturally and independently of at least deliberate devising, and in so doing have sometimes given rise to multitudinous other and diverse things and activities, thus profoundly affecting man's psychological as well as racial development, and hence contributing inexorably both good and evil lessons and influences to his culture everywhere, and everywhere similarly.

If, moreover, I am at times seemingly too personal in style of statement, let it be remembered that well-nigh all anthropology is personal history; that even the things of past man were personal, like as never they are to ourselves now. They must, there-

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fore, be both treated and worked at, not solely according to ordinary methods of procedure or rules of logic, or to any given canons of learning, but in a profoundly personal mood and way. If I would study any old, lost art, let us say, I must make myself the artisan of it—must, by examining its products, learn both to see and to feel as much as may be the conditions under which they were produced and the needs they supplied or satisfied; then, rigidly adhering to those conditions and constrained by their resources alone, as ignorantly and anxiously strive with my own hands to reproduce, not to imitate, these things as ever strove primitive man to produce them. I have virtually the same hands he had, the same physique, generally or fundamentally the same activial and mental functions too, that men had in ages gone by, no matter how remote. If, then, I dominate myself with their needs, surround myself with their material conditions, aim to do as they did, the chances are that I shall restore their acts and their arts, however lost or hidden; shall learn precisely as they learned, rediscovering what they discovered precisely as they discovered it. Thus may I reproduce an art in all its stages; see how it began, grew, developed into and affected other arts and things—all because, under the circumstances I limit myself to the like of,—it became and grew and differentiated in other days.

If the subject be in paths somewhat different from this, as, for example, some portions of my present essay are, I shall also think of it as it related to primitive men in primitive state of mind. I would divine how the men of old felt about their arrows, and what, therefore, they did to them and with them. They were simple, like little children, given to looking on their favorite things as the children of today look upon favorite toys, with a vast deal of personal feeling, emphasized in their case, to huge proportions, by the tremendous part these arrows bore in their lives. They had no knowledge of physics to guide them. Analogy was their explanation of relations, and the dramatic interpretation of these relations and the phenomena thereof their only logic, and so, behold, the arrow was for ages looked on as a wand of enchantment to those who made and used and lived by and loved it; was to them a symbol—a veritable portion and potency of the mightiest forces and beings that they thought the world and four quarters, the sky, or the under earth held; was

thus transcendent over the skill of their deftest archer; was a thing of magic, and was willful, as like to obey the wind-bird with whose feathers they had winged its shaft withal, the god in whose breath it wavered, as to obey themselves or him who wrought and loosed it; for itself would decree his luck or his fate, not he who sped it, else why all so vainly at times, however great his skill or his effort, did he speed it? Therefore it played as large a part in their theoretical and mythical as in their practical life, and must be theoretically and imaginatively, no less than practically and experimentally, studied.

IV

MY DISCOVERY OF ARROW-MAKING

I tell you in detail, then, how, through making many arrows, I have studied the arrow and its development practically; how, by using it unweariedly and consorting long with those who used it actually with natural purpose and method, as well as by pondering deeply upon it in the most primitive moods I could muster, I have studied, theoretically, too, its meanings and relations; the place it held in men's hearts and minds ere ever they knew of goodlier friend or deadlier foe.

When I was a boy less than ten years of age, my father's hired man, while plowing one day, picked up and threw to me across the furrows a little blue flint arrow-point, saying: "The Indians made that; it is one of their arrow-heads." I took it up fearfully, wonderingly, in my hands. It was small, cold, shining, and sharp—perfect in shape. Nothing had ever aroused my interest so much. That little arrow-point decided the purpose and calling of my whole life. It predestined me, ladies and gentlemen, to the honor I have in addressing you here today, on Arrows; for I have studied archeology far more, alas, than anything else—ever since I treasured that small arrow blade on the lid of an old blue chest in my little bedroom, until the cover of that chest was overfilled with others like it and with relics of many another kind.

I was fortunate enough, not long after, to find in a neighboring field a place where some of these blades had been made. I could see that they had been fashioned in some way by chipping, for the scales lying there were like those I had been wont

to strike off to see the sparks fly. When in course of time I had gathered a collection of some hundreds of relics from all over central and western New York, I began a series of experiments to learn how these arrows had been made. No one could tell me, and I had no books on subjects of anthropology then.

There was a farmer in our neighborhood who, when young, had gone to California. It was in the days of "Forty-nine," and he had been pricked in the shoulder by an Indian arrow. He may not have killed the Indian, but had, at any rate, his whole sheaf of arrows—quite as perfect a set as I ever saw. They were all pointed with obsidian tips, like mine in shape and finish, but smaller. In recognition of my passion he gave me two of them. I thought the points were of glass, and forthwith added all the thick pieces of bottle-glass and window-plate I could gather, to my store of raw material for practice. With this I worked, now and then, throughout a whole season, but the products of my hammerings, though fair, were but crude compared with those of the field.

When nearly fourteen years of age I discovered in the woods south of Medina, New York, an ancient Indian fort. I built a hut there, and used to go there and remain days at a time, digging for relics while the sun shone, and on rainy days or at night in the light of the camp-fire, studying by experiment how the more curious of them had been made and used. One evening I unearthed a beautiful harpoon of bone. I had a tooth-brush. I chopped the handle off and ground it down on a piece of sandstone to the shape of the harpoon blade, but could not grind the clean-cut barbs in its edge. I took my store of flint scales and set to work on it, using the flint flakes in my fingers, or clamping them between split sticks, saw-fashion. The flint cut the bone away as well as a knife of steel would have cut it, but left the work rough. Now, in trying to smooth this I made a discovery. No sooner had I begun to scrape the bone transversely to the edge of the flint than the bone began to cut the flint away, not jaggedly, as my hammer-stone would have chipped it, but in long, continuously narrow surface flakes wherever the edge was caught in the bone at a certain angle. I never finished that harpoon. I turned it about and used it as an arrow-flaker by tying it with my shoestring to a little rod of wood for a handle and pressing it at the proper angle to points on the flint which I wished to re-

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move. I made arrow after arrow thus, in the joy of my new discovery, until my hands were blistered and lacerated, in one place so deeply that the scar remains to this day, and, worn down to a mere splinter, I still preserve my first tooth-brush flaking tool. (Fig. 1.)

I did not know at that time that archeologists the world over were ignorant, as I had been, of just how flint implements had been made, and I did not learn until my now so lamented friend, Professor Baird, called me to the Smithsonian Institution, in 1875, that I was the first man, or rather boy, of our day who had practically discovered how to make implements of glass and flint flaked from side to side, and in this indistinguishable from those made by primitive peoples.

I have told this history as it occurred for a three-fold reason: first, to instance the manner in which I discovered flint-flaking, by chancing all ignorantly to follow precisely the course primi-

FIG. 1.—Experimental flint-chipper of bone.

tive men must have necessarily followed when and as soon as with the hardest and sharpest stone they could get, which was fractured flint, they tried to scrape and fashion bone or horn; and, secondly, to convey to you the lesson this boyish experience taught me; that I could learn more by strenuously experiencing with savage things and arts or their like than others or I could have learned by actually and merely seeing and questioning savages themselves about such things and arts. Long before I went to the Smithsonian or lived in Zuñi I had elaborated from the simple beginning I have chronicled here, some seven or eight totally distinct methods of working flint-like substances with Stone-age apparatus, and subsequently have found that all save two of those processes were absolutely similar to processes now known to have been sometime in vogue with one people or another of the ancient world, and I confidently look to finding that the other two, and yet additional methods since experimentally made out, were somewhere followed by men before me. And, thirdly, there is another lesson of later development this

experience has taught me: that paleolithic man, of the French caves at least—that man who is said to have known no other art of working stone than by rudely breaking it into shape by blows of other stones—could not have existed in such primary status of art for more than a few seasons at most; for even the casts of these cave remains that I have seen show carvings in bone and reindeer horn finished to such nicety and cut so elaborately that with the splendid true flint of Europe, experience in making any one of them would have given birth to the wit of making and applying a hundred flaking tools. As might be expected, therefore, I find among the casts of the French cave objects in our National Museum and in the University of Pennsylvania several fine and well-worn flint-pressers, a flaker or two, and reproductions of even one knapper of horn, and all these things are polished with art as of polished stone.

V

THE TYPICAL ARROW

Before I briefly relate and show how arrows of the ancient world were made I must need describe them, but not in all their variety and detail.

Those of the American Indian are, as a whole, fairly representative of all others, and to the student who would become familiar with the characteristics of nearly all classes of these I would recommend that most excellent and admirably illustrated "Essay on North American Bows, Arrows, and Quivers," written by Dr Otis T. Mason and published in the Smithsonian Report for 1893, to which I am myself so much indebted.

You are all familiar with the toy and target arrows of our time, but you may not be aware that all toys, wherever found, with the slight exception of but a few very modern and mongrel mechanical devices, are survivals of either the weapons and utensils or else of the religious paraphernalia of antecedent times, and that this familiar arrow of the archery clubs is no exception to the rule, but is an excellent representative in all essentials, save only for its blunted pile, of the arrow that won our preeminent place in the world—the arrow of the Norman Conquest, of Cressy, Poitiers, and Agincourt, of old England's matchless bowmen. But still it is not quite typical of its prehistoric kind.

The arrows of the Age of Stone may be best represented, I think, by one of their most highly developed forms—that of the famous Cliff-dwellers of the southwestern cañons, for in this we find combined the features of nearly all other kinds. In that matchless collection of very ancient remains from the cliffs gathered by the Wetherell Brothers and the Jay Smith expedition and now owned by Colonel C. D. Hazzard, of Minneapolis, which is on exhibition, I am happy to say, in the Museum of the University of Pennsylvania, are many specimens of this arrow (Fig. 2). They are from thirty inches to nearly a yard in length; are tipped with delicately flaked, diminutive points or piles of chalcedony or obsidian. Some are barbed and tanged; others are merely triangular; but each is set into a nock or deep notch at the point of a tapering, hard-wood fore-shaft, and firmly attached thereto by alternate cross-wrappings of sinew. The fore-shafts are about half as long as the shafts or steles, which consist of medium-size reeds or canes, and are fitted with shoulders and thence tapered sufficiently to be let into these slightly smaller ends three or four inches—far enough to rest against the stop or septum of the first joint—and are held in place by a seizing or binding of sinew around the shafts at the points of insertion.

The steles or bodies of these cane rear-shafts are some of them grooved with long, straight, or wavering lines, and are not only winged at the shaftments or base ends with feathers, but are also footed—that is, the extremities have been split slightly at four, sometimes only three, equidistant points, and plugs of wood have been set into them and bound in place by sinew to receive the nock for the bowstring, somewhat as strips of hard wood are let into slots of our spruce target arrows to keep them from split-

FIG. 2.—Foreshafted reed arrow of ancient Cliff-dwellers, showing tip, foreshaft, and footing-plug insertions.

ting when drawn or loosed. Each of these arrows is winged with three half-plumes, mostly split from the first six pinion feathers of eagles or falcons (for they happen, with one or two exceptions, to be war arrows), which are laid equidistantly along the shaftment the length of one's palm and forefinger down to within an inch, more or less, of the footing, and seized at the ends with sinew and glue. One of the plumes of each arrow, called the "tail" by the Indians and the "cock feather" by the old English archers, was placed so as to stand out exactly at right angles with the nock of the arrow, and, as I shall presently show, was most significantly tufted and notched, primarily to denote that it was to be uppermost when the arrow was nocked, so that neither of the opposite feathers or "wings" should touch the bow when the arrow was loosed from the string.

Finally, around the shaftment, between the feather-seizings, bands or ribands of color were painted, red and black, chiefly, and variously disposed, also most significantly, as we shall soon see. Arrows of the kind I have just described are called "compound." Arrows with shafts made from single rods of wood are called "self" arrows, and, strangely enough, although apparently simple, they more often than not have tokens of derivation from the compound kind, and the successful making of them was much more difficult.

VI

THE MAKING OF ARROWS

As shown by my experiments of many years, by the scattering allusions of travelers, and, more than all, by my life with an archaic, very archaic, people, the steps in the manufacture of arrows, of their points of flinty stone, which men of primitive days most widely followed, were few and simple, yet exceedingly curious and ingenious.

They first sought the material, mined it arduously from buried ledges with fire, mauls, and skids,* or, preferably, when the country afforded, sought it in banks of bowlder-pebbles, digging such as were fit freshly from the soil, if possible, and at once blocking

* The reader is referred to the various masterly essays on this subject by Mr. Wm. H. Holmes and one by Mr H. C. Mercer, published in former issues of this magazine.

out from them blanks for their blades by splitting the pebbles into suitable spalls, not by free-handed percussion, but by holding them edgewise on a hard base and hitting them sharply and almost directly on the peripheries, but with a one-sided twist or turn of the maul or battering stone. With each deft stroke (Fig. 3) the spalls, sometimes twenty from a single cobble or block of moderate size, were with almost incredible rapidity trimmed to the leaf-shape basis of all primitive chipped tools by knapping them with a horn, bone, or very soft, tough, granular stone hammer mounted in a light handle. For this the spall was placed flatwise on the knee or on a padded hammer-stone, so called, and held down by the base of the thumb of one hand (Fig. 4) and rapidly struck along the edge transversely and obliquely to its axis lengthwise, with the outwardly twisting kind of blows used in the splitting. The blanks thus formed were then carried home for leisurely or opportune finishing, and carefully buried in damp soil, not to hide them, as has been usually supposed, but to keep them even-tempered or uniformly saturated ("full of sap and life,' these ancients thought), whence the so-called "caches" of numerous leaf-shape blades which are now and then found, for example, throughout old Indian ranges.

FIG. 3.—Splitting spalls or flakes from mass for blade-blanks.

FIG. 4.—Knapping or shaping blade-blank from spall.

In finally forming arrow-points from these trimmed blanks, the smallest of them only were chosen. The first care in fashioning one of these was to remove protuberant points from its

edge and sides and to thin it down by means of a pitching-tool of buck-horn. This was effected in several ways, usually by clamping it in a folded pad of buckskin under the knee against a hammer-stone or notched wooden block, so that the projecting edge rested over the margin or else over the pit of the stone, or notch if a block or log were used, and with one hand holding the point of the pitching-tool very lightly and slantingly and at a wide angle, against or just over the points to be chipped, sharply tapping the tool with a maul or with a knapping hammer (Fig. 5). Thus the blade was quickly thinned down and made almost even-edged. It was now further shaped, sharpened, nocked, or barbed or serrated, according to intended use, and tanged, with a rounded, flat bodkin of horn (seized to a stick or handle for leverage at one end and tapering therefrom to a curved, blunt point), either by laying it on folded buck-skin, over the hollow of a hammer-stone (Fig. 6) or the palm of the left hand, pressing it downwardly along the edges at nearly right angles, and always slantingly to its length, or else by holding it edge up between the thumb and all the fingers of the left hand and freely flaking it, with the rod held in the right hand (Fig. 7), with handle braced against the ribs for steadying, by pressing the sharp edges until they caught in the point or blade of the bodkin, and twistingly wrenching them off by a most dextrous motion, which I can exhibit, but not adequately describe or illustrate.

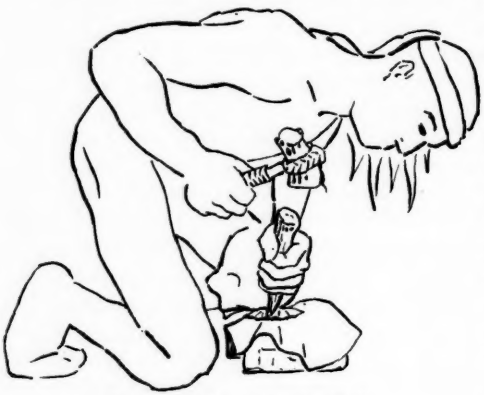


FIG. 5.—Pitching or trimming blade.

All this sounds complicated and tedious, but I have succeeded from the time I found a suitable pebble of fine-grained, ringing, cold and fresh quartzite, in making seven finished knife and arrow

blades in exactly thirty-eight minutes, and I have often made from obsidian or glass a very small and delicate arrow-point—the most easily made, by the way—in less than two minutes.

When a number of the points had been finished they were warmed by the fire and rather ceremoniously enwrapped in buckskin or fur, not more to keep them safe than to "cure" them of all this rough handling and win them to favor and strength, for by the very clink of the perfect ones it was known now that they were full of life, each of its own—the life and fire of the lightning, which could be seen at night when they were rubbed or struck against one another or ground on a sharpening stone.

FIG. 6.—Chipping by downward pressure.

FIG. 7.—Chipping and nocking by cross pressure or wrenching.

When war work was impending these old-time artisans or fletchers went forth "sprout making and cane-cutting," as they called their gathering of reeds and twigs; or when later, as the Pueblos did, they abandoned the compound arrows of their ancestry and took to horse and short bows, they called it "cane-sprouting" when they gathered, all green, their shaft twigs, or "browsing" when they designed them to serve for the chase. These twigs were cut with due sacrifice to the wood sprites, were brought in head or upper ends fore-

most, passed over the store of points to make them acquainted, and laid down with their tip ends to the east or south if for the peaceful hunt, to the west or north if for war. They were peeled upwardly, or from butt to tip, that their way of working be not balked; scraped and shaved to uniformity, also from the butt upwards, and placed alongside a hot fire or buried in moist, hot sand to soften or "ripen" them; and then, after being bitten straight in the most crooked places (Fig. 8)—it did not much matter how crooked they were at first—each in turn was clamped between one nether, grooved piece of sandstone or sanded wood

Fig. 8.—Shaft-biting for preliminary straightening.

and one small flat piece held over it firmly in the left hand, and was shoved and pulled twistingly back and forth until smoothed and rounded and further straightened (Fig. 9). Finally, each was both seasoned and polished, then straightened to a nicety by passing it, under heavy pressure, over a smooth grooved piece of very hot soapstone, or else, better still, by heating it and "stretching" it through a veritable drawplate of bone, horn, or hard wood (Fig. 10) furnished with a single medium hole or with several beveled perforations. While being stretched the shaft was wrenched with a quick turn here and there at remaining crooked places, then smoothed

down by additional and gentler stretching, that it might be coaxed to keep straight. When fully stretched, it was grooved along three or sometimes four places on its circumference with the tusk of a puma or wild cat (of fiery eye) if for war, with elk, beaver, or other gentler kind of tooth if for the peaceful chase. With the point of this tooth the shaft was pressed alongside of the stretching plate as it was being finally pushed through from tip to shaftment place (Fig. 11) or feathering point—twistingly for at least every alternate groove—that a wavering trail might be made for the lightning to traverse from point to quill when the feathers whistled, speeding the sure flight of the arrow.

FIG. 9.—Shaft smoothing by grinding.

The shaft came forth from this operation lengthened considerably, polished, groove-marked, straight in the main, but bent perhaps along its full length. If so, it was warmed along the inner curve of the bend, held, tip outward, in the left hand, the butt grasped by the right (Fig. 12), and was bent a little this way and that till true, held so a moment, and laid down close to the fire, where it speedily dried to rigid straightness, until perchance rained on. The shaft was nocked at the lower end first by notching it deeply with a flint sawed across (but more or less with) the grain and by rasping out the bottom of the notch with a blunter-edge knife or sanded string and by heating, and spreading the flanges thus formed with a rib or other

hard edge or with a hot stone. If a split appeared or was likely to appear, the foot was whipped with sinew.

FIG. 10.—Shaft "stretching" or final straightening with draw plate.

Now it was ready for feathering. Three pinion feathers, all from the right or all from the left wing of eagle, hawk, or turkey were chosen and cleft from tip to base by splitting and pressing the quill apart along its inner groove or mid rib. The featherings were all chosen from corresponding sides of the mid rib, that they might be uniform. The pith was scraped out of the lower parts of the quills until they were thin and flexible, and the edges of them were pared away. They were now laid flat along the shaftment, the bases of the quills toward the tip, first the right-wing quill, then the left-wing quill, so called; finally the tail quill; the latter transversely to the nock to serve as a cock feather.

FIG. 11.—Shaft grooving with tooth and draw plate.

All were seized on with filaments of mouth-moistened sinew, one end held in the teeth until a turn or two of the wrappings had been taken to keep the feathers in place. Then one end of the shaft was held under the left arm, the other between the thumb and forefinger of the

left hand (Fig. 12 a b, *a*). The thumb and the fore and middle fingers of the right hand were moistened, and with them the shaftment grasped over the first wrapping. The sinew filament was drawn taut and held so between the middle, little, and ring fingers and the edge of the palm, and the shaft rapidly twirled with the thumb and fingers of the left hand (Fig. 12 a b, *b*). Thus the bindings of sinew were pressed flatly and tightly on as it was wrapped, and, being moistened and very fine at the ends, adhered without further fastening.

Now the lower ends of the featherings were similarly fastened, some of the pluming or alæ being usually seized on together

Fig. 12.—Shaft-truing.

with the quill to strengthen and tuft it, and the plumes being stripped down once or twice spirally with a double motion to make them lie flat, were finally pulled through at the ends to straighten them, and flatten them still more.

After all the shafts had thus been feathered the whole bunch was taken in hand, the butts struck against the ground or a stone, then reversed and righted, and with a puff of the breath thrown down, ends forward. According as the arrows rebounded and fell, they were carefully sorted into groups, and with the more highly developed tribes, like the Zuñi, the cock or tail feathers

of each group were notched, trimmed, and tufted differently from those of the other groups, to denote their classes as being, one set of the north, another of the east, and the others, respect-

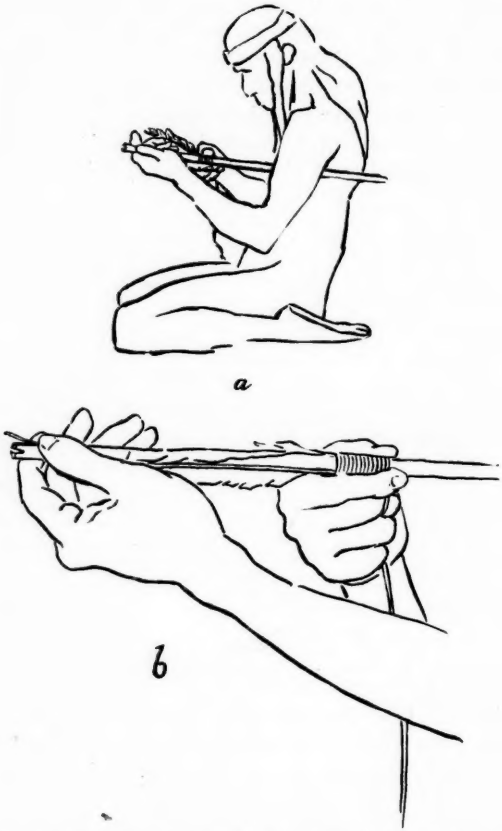


FIG. 12 a b.—Feathering and seizing; *a*, position in holding; *b*, of fingers in twirling and binding.

ively, of the south and west. The top- and mid-most shaft was reserved as a personal arrow for special treatment, and the doubtful shafts were left unfinished. At last, in correspondence to the

kinds of shafts as indicated by the cock feathers, the points were selected, the keenest and deadliest for the north and the west, the broadest and shortest for the south and the east. The tips of the shafts were nocked and rasped, each with the base of the point designed for it; and the points were then seized on free-handedly with sinew, as I have described heretofore. All these increasingly solemn operations were concluded by the orderly ribanding of the shaftments with the colors of death and blood—black and red,—or with the yellow of magic, or the green or blue, of life and victory.

The arrows were finally laid out to the west or the east and breath-endowed with lives of their own; then placed with their parent, the fire arrow* (all save its consort, the personal one), in their quiver, heads downward, feathers upward, that the lightning run not out nor the feathers speak before their time, but sleep till wakened for war council and "feeding" or medication.

Fig. 13.—Turning or chamfering of fore-shaft.

I find evidence that the Cliff-dwellers followed much these same methods, save that the fore-shafts were made differently, and the order of proceedings, as evidenced dingily by traces on these old-time shafts, inspected in old-time mood, was accordingly different.

The fore-shafts were, for instance, tapered and rounded, chamfered, and the shoulders cut on them all by twirling (either with the fingers or with the hand on the thigh) between gritty stones (Fig. 13)—as early a kind of lathe-work as I have learned of, this! Moreover, before the cane-shafts were grouped to the

*This was not always an arrow, properly, but a shaft carried ever ready for use as a fire-stick or drill, in the quiver. It was usually, however, made from a well-tried arrow, and was called fire-reed or arrow, by the Zuñi. I am assured by that distinguished Arabic scholar, Dr Talcott Williams, of Philadelphia, that such must have formerly been the practice of the Arabs, for he finds that their terms for arrow and fire-stick are likewise similar.

four quarters and the points chosen for them, the tips were fastened to the fore-shafts, as belonging to them,—being their shanks. This and many other interesting, highly significant details, I have made out; how, I cannot pause to relate, but with Zuñi lore and language, as well as reason, on my side.

Nor is there time for analyzing all of these customs and explaining how many of them are survivals of originations so practical and simple withal that they must have been measurably similar and universal in given conditions of culture-growth; but it may be well for me to explain that, being survivals of ages and successions of experience, we must eliminate one after another, the more elaborate of them as we think backward in time; that we must do the same with the working processes I have been earlier describing also; and if you will bear with me during a few moments more of detailing, I will try thus to lay bare not all the stages in stone-working and arrow development, but what seem to me to have been their primal beginnings.

VII

ORIGIN OF EARLY ART AND OF LANCE-FORM TOOLS

In a series of lectures given last spring at the Drexel Institute of Philadelphia, and in other papers, I have brought forward some of the many reasons which have induced me to suppose that man began his art development—his really manual and therefore mental and human development—on the coast of the sea of some tropical or temperate Old-world land. I cannot enter into the matter here much farther than to state that this human ancestor could not well have developed the habit of erect walking until forced from his earliest arboreal habitat and compelled to fend for life with his own hands, and thus taught to use them more for seizing and doing than for climbing and merely clutching, and thus also taught by his hands to devise, and with them to devise purposefully.

Now, in this period of transition from forest to open, from a condition all but as artless as that of the higher tree-dwelling Quadrumana to a condition demanding rudimentary art at least, man could not have subsisted, it seems to me, in any other environment away from his fruit-giving trees, than near to the food-

teeming sea, which, in dry season and wet, in cold and in warmth, ever abounded in easily taken creatures and things edible. The universal craving or liking man has for salt—especially with his meat food—would seem to point to some such profound and primal experience-period of the race as that. The well-nigh universal association of the sea-shell with fire ceremonials, would indicate that thus, too, on the coast of the sea he first learned to fear fire little enough to capture and keep or carry in shells, its seed or young; to loose and feed them, for protection at night, and from cold, and thus also to use them—the all-devourers—for half eating for him, food else too tough, too cold, or otherwise too hurtful for his eating. And, finally, the universal distribution of our kind coastwise, it would seem, the whole world over, ere ever language even had been developed vocally from hand usage and gesticulation far enough to remain steadfast or undifferentiated structurally in every great continental area, would also, along with much evidence of the arts, not least of them the arrow arts, still more strongly evidence the same sort of thing.

We can readily enough conceive that it was on the old ocean shore man learned to crack food things—shell-fish and bones—against the convenient stones of the beach; then to crack them with stones, and thus to crack stones against other stones in order to make them in turn crack these food-things the better, and at last to crack such cracking-stones with other stones, wherein he became a tool-making creature—that is, used tools with which to make other tools or with which to imitate and better mere use-made tools; and this was, and here ended, his *true* paleolithic period.

It was there, too, in the soft sand or mud of the seashore, that we most naturally think he learned to dig (for shell-fish and the like) with sticks, wearing them sharp thereby, and thus learning also to wear them sharp intentionally, in order to make them sharp; and from prodding the sand away from his food, it was but a step for him to prod his fellows—or anything else that stood in the way of his food—and thus-wise would begin the development of the pike, the lance, and the spear; the harpoon, the dart, and the arrow. The seeming likelihood of all this would lead me to linger yet a little longer by the seashore with my earliest man. Moreover, I think I can thus explain better

than elsewise quite other things about the arrow than merely its beginning, and can perhaps make it evident that I am not so fanciful as would seem, in this speculation.

First, as to the stages of tool and weapon making, there are three examples of the way in which awkward-handed, experienceless-minded beings began making (or, rather, using) things as tools. They are to be found in the acts of monkeys, imbeciles, or very young children. I have watched and experimented with all three studiously and long. If they would break a thing, they cannot—or at least they never do—dissociate the thing to be broken from the breaking of it. They hit it against something bigger. My friend, Thomas Eakins, the scientist-artist, of Philadelphia, has a pet monkey named Bobby. As Mr Eakins is honoring me by painting my portrait, I have had opportunities for observing Bobby. Now, if you give Bobby a large, hard nut that teeth will not crack, he instantly looks about for a stone or other hard object (he one day chose—literally hit upon—my head) and proceeds to maul the nut against it until broken. Although his master has surrounded him with convenient stones and sticks, he never uses them against the nut, but ever the nut against them, and if his curiosity be aroused as to any one of the nut-like stones, he hammers belike this stone against another, until it—not the stone he hammers—is broken, or if accidentally he breaks the stone he is hammering upon, he gains no lesson therefrom, but promptly seeks another stone on which to hammer the one he would break.

Very little children, if untaught or non-observant, do things in this way, and as far developed as the Tasmanians were above this stage of art, they still practiced edging their hard pebble-choppers (Fig. 14) by seizing them with both hands—the more accurately to direct them—and whacking them until chipped sharp obliquely against other stones, and in this they were, but a few generations ago, in the true paleolithic period of their development.

There are also three contemporary examples of the early use of a prod as a weapon—of at least the chase. These are: Bobby again, young children, and (I say it not gracelessly) women trying to drive chickens or cattle or other frightful creatures. Bobby hates a certain too curious cat, and is not sufficiently scared by her to fear showing fight whenever she appears.

If the cat happens to steal near, but keeps beyond the reach of his tether, he does not throw a stone at her; but he has a long stick with which he hauls things toward him when put beyond his reach and with which he scratches them up when they are buried nearby. While it never occurs to him that he can reach the cat with a stone by hurling it at her, yet he tries to reach her with the stick by lunging it at her. He has thus learned that if he cannot punch her in this way, nevertheless he can hit her, and educe the desired and delightsome squall by lungingly hurling it at her, and he does this now with increasing skill and frequency; never by actually throwing it, but by lurching it forward with both hands, and as much with the body as with the hands and arms. If you ever see awkward women or children after anything with a "sharp stick" you will observe that they throw it, if they cannot catch up, in much the same fashion—lurchingly, not overhand, as a spear should be thrown, for that would discontinue the initial movement.

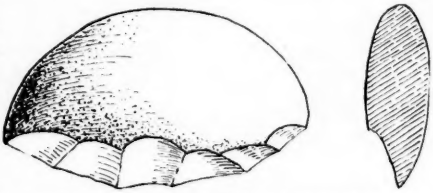


FIG. 14.—Outline and section of Tasmanian chopper-pebble.

And now, I will trace the arrow up from this lowly and slow-paced infancy, to his manhood and marriage with the home-staying bow, for whom he has ever since so swiftly obeyed and run errands.

VIII

DEVELOPMENT OF ARROW-FORM MISSILES

From such breaking of shells, stones, and bones such as I have characterized, and much cutting of his fingers thereby, primal man must have learned speedily enough to do all sorts of cutting, scraping, and scratching with the sharp fragments thus produced. For long, however, he probably used these fragments unmounted, grasping them, perchance, with wads of seaweed or grass, or, when large, winding or clasping them in wisps of fiber or rolls of integument for holding, as I have grasped the stone

here exhibited (Fig. 15), with a fold or two of buckskin, in making with it the shaft-polishers and other like tools I have needed to use in my recent experiments for these demonstrations.

But by lodging such blades in wood or often wedging sharp things into the end of his pike-form digging stick, he must have learned in time that the stick, so long as thus armed, dug better (and cut his contestants or his prey better, too) than ever merely with its wooden tip, no matter how well seasoned by heat or favored by long-tried use this was. Then he tied or otherwise attached suitable chips to his digger, which he may have sharpened in the old way—at the other end (Fig. 16)—as the Tasmanians used to, but which we may imagine he now shortened—having more of use for its peaceful than for its offensive purposes*—until, at need for the capture or the fight, he got a reed from the seaside rivers or marshes, straight and long and light enough to punch withal or fling, if it but had a point, and

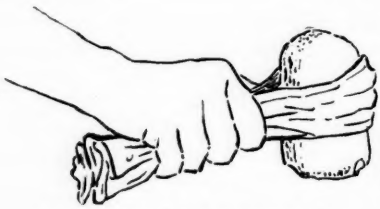


FIG. 15.—Makeshift haft of hammerstone.

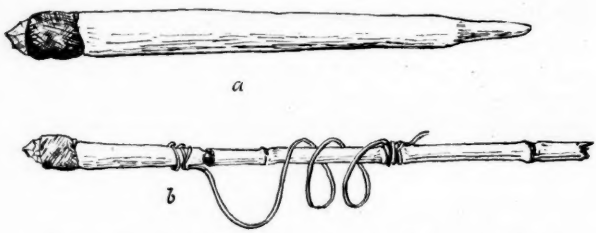


FIG. 16.—*a*, Tasmanian knife-pointed digging stick; *b*, mounted in reed shaft as spear.

mounted his stone-bladed picker in one of its hollow ends, thus again lengthening it, at will. Lo! the fore-shafted spear, twin-changeling of the shaft-handled dirk and knife! Thus was born, with many another first form of the things we use, the ancestor

*The digging-sticks of the Australian women (of the interior) were, unless tipped with stone, often six or seven feet long, and were used not only as implements, but also as weapons, either as quarter-staffs, sidewise; or as pikes or headless lances, endwise.

alike of the retrieving arrow and of our familiar pocket companion—pencil and wit-sharpener of those who write—long before man was weaned from the skirts of his Gray Old Nurse, the sea—born there, in time to drift with him, ere yet he left her side, over the whole shore-land world.

We have but to note the long and tapering forms of prehistoric stone knife-handles everywhere pointed—not quite usefully otherwise than as survivals of an early use—to believe in this thought as not improbable. Then, too, we may note the unearthed knives and harpoon-heads of the early coast- and island-dwellers of California, or of the ancient fisher-folk of Peru and Chili (Fig. 17), to see that each is so like the other as to puzzle

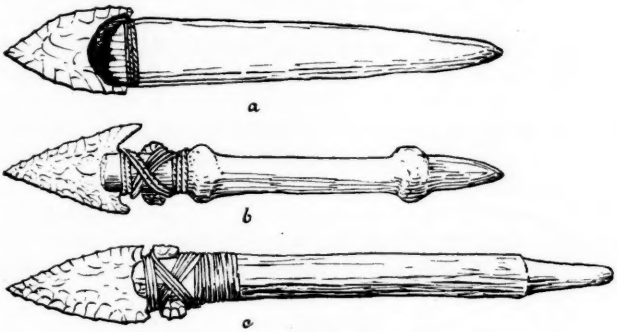


FIG. 17.—Knife-harpoon heads; *a*, California; *b*, Peru; *c*, Cliff-dweller.

the sharpest observer. The handle of each, though preserving its ridges at either end, alike useful for grip-guard or reed-shoulder or tying (*b*), may not denote that each was used at so late a time indifferently for either purpose, but it seems to say that its ancestor was so used for very long. When, some time early, man found that the slim-handle knife, getting loose in the shaft of his spear, pulled out with the fish he had struck, but that if tied with a long enough string held its prey quite as well as the whole spear when held by a string in his hand, he had but to transfer his retrieving line, which always had hindered the fling, from hand-hold to mid of the shaft, and from thence to the hilt of the head, to have formed a perfect harpoon. (Fig. 18.)

Imagine how men in those old days thought of the sharp-

beaked shafts they cast at fishes and water fowl! They must have longed every day to emulate the osprey and the fish-hawk! But although they made their harpoons hook-beaked with barbs (or had made them so already) and claw-headed with recurved bone prongs, yet their flights of them were none the better for all that! Then why not tie hawk feather or eagle plume to the body

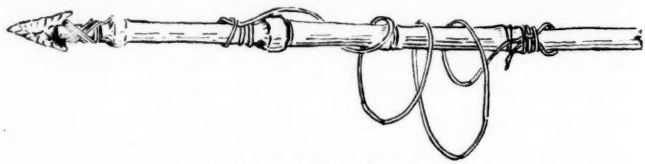


FIG. 18.—Knife-headed harpoon.

of the missile? How such feathers flew and flew, whether with the bird they belonged to, or when dropped in the wind! Forthwith, you may be sure, they tied wing feathers to their shafts, two at first, midway; but lower down after awhile, and with a third feather, the "tail," for the smaller shafts, to keep them straight and headwise. Primitive man never, until after the time of Homer, got over this believing (as his kind believe today), that the flying quality of the feather and of the bird it came from gave light swiftness and sharp sureness to his bird-bolts, not the feathering in itself.

IX

ORIGIN OF THE DART-FLINGER AND BOW

Using spears and harpoons with irregular poles, or shafts of jointed cane, man found a mighty advantage in those which had knobs or joints large enough to afford sure grasp to the hand in throwing, especially men of the water side, where their things were so often wet and slippery; and still greater advantage they gained from this experience later, when with plaited girdles or bands of other sort

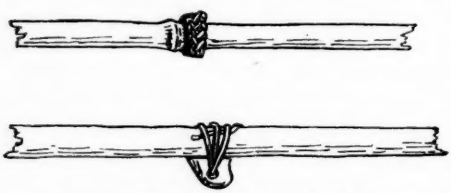


FIG. 19.—Shaft-girdle and clutching-knob.

they enlarged these joints at the grasping point or bound to the shafts, knobs or catches, of ever better and better device for the special work in hand (Fig. 19). They found, too, that for

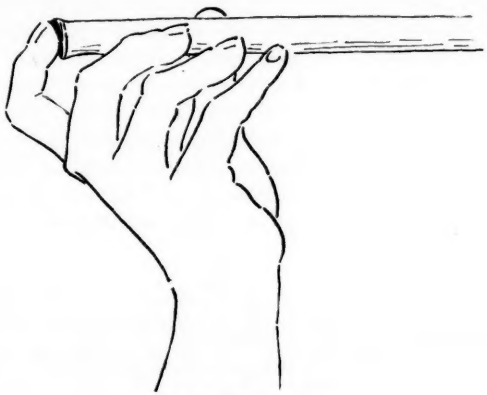


Fig. 20.—Finger-throw.

far throwing and small quarry the light javelin was best, and that he who had the longest arm could hurl it the farthest; he who had the strongest fingers and could launch his missiles with one or another of them used as a lever behind, like a hook

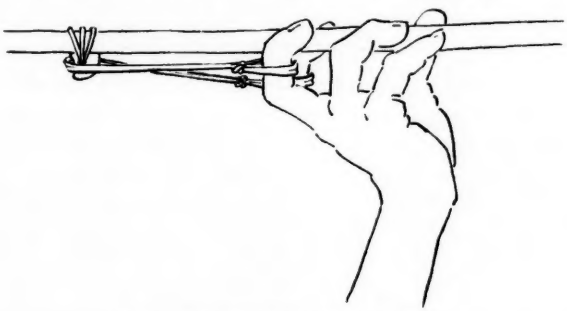
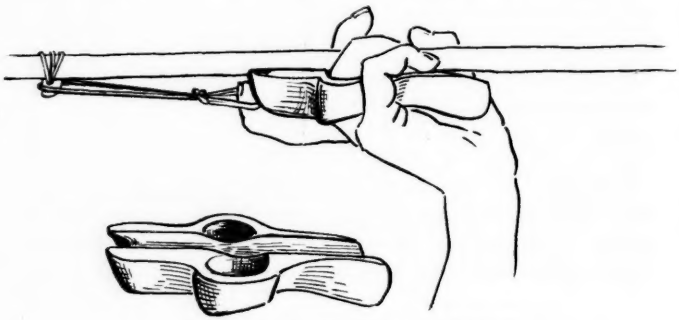


Fig. 21.—Spear-noose or slinging strap throw.

against or inside of its hollow butt (Fig. 20), was surest of aim and sharpest of stroke.

So presently they began to fit the shafts with straps or their fingers with slinging-nooses (Fig. 21) to farther the flight. From

the soreness which came of much or constant use of such first appliances (I have tried them and know), it was needful to make them ever better and better, until the loops became rings for the fingers, more rigid, and joined together; and these, in turn, became palms of rawhide for the throwing-hands, or of wood hollowed straightly and fitted with holes at the sides for the thumb and great finger, and with a groove underneath extending to the rear end, at which was a notch or a hole for this finger when stretched back along the groove and thrust up through the hole or over the notch to hold the noose of the sling-strap (Fig. 22) or press against the shaft-butt, so as to project with force the spear when, if long, it was thrown with both hands.



FIGS. 22, 23.—Spear-palm and slinging strap.

Of such early devices as these spear-palms or graspers, so to call them, I have happily been able to find two historical examples, and doubt not others will yet be found. One of these, although a true spear-thrower, is quite such a palm as I have described, save only that it is a little too long and is furnished with a rude catch of bone in place, as it were, of the fore-finger-nail. It was rescued from the Santa Barbara Indians, ere they became extinct, by that great voyager Vancouver.* There was found, too, some years ago, another of these things, even more archaic, a veritable spear-palm, such as I have described, but

*This specimen has been discribed in the Journal of the Anthropological Institute of Great Britain, vol. xxi, London, 1891, by Mr Charles H. Reed, of the British Museum; and both rediscribed and figured by Professor Mason in his little paper on "Throwing-sticks from Mexico and California," published in the proceedings of the National Museum, vol. xvi, No. 932.

beautifully inlaid with bits of haliotis shell. I saw it in a collection of remains from the islands of the same region, but did not know, and no one at the time knew, what it was. I have now, however, identified it and reproduced a plain one like it (Fig. 23) and used it successfully. Perhaps the most interesting historic relics showing survival, I believe, of such uses of the spear-palm device as are here referred to are to be found in collections of Etruscan and early Roman remains.

At the Washington meeting of this Association, as may be remembered by some, my friend, that brilliant and many-sided naturalist, Professor Edward S. Morse (who did more for the study of "arrows" as a subject than any one previously, in his

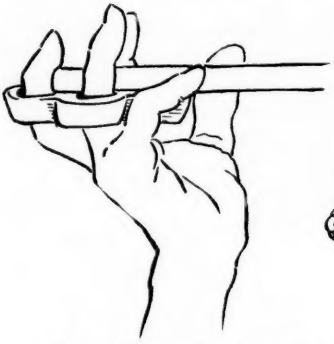


Fig. 24.—Finger position in spear-palm clutch.

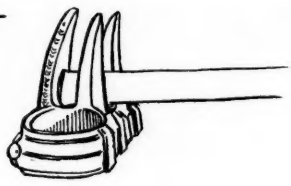


Fig. 25.—Etruscan "bow-stretcher;" probably spear-clutch.

striking and oft-quoted work on "Arrow Release"), held up before our section and discussed some of these remarkable little bronze relics, telling us that they were called "bow-stretchers" or "bow-stringers," ordinarily, in European museums; that, however, antiquarians were not satisfied, nor was he, that they were such, and that all sorts of opinions, equally inconclusive, had been advanced as to their possible use. He then, seeing me, handed the specimen to me, remarking very kindly that "if any one could make out their meaning, Cushing could." Although then I was dubious, today I am grateful for both the compliment and the opportunity; for, comparing this old Etruscan relic with such a double spear-ring or clutch or such a spear-palm as I have described (Figs. 24, 25), one sees that the spikes or prongs

on it so resemble the fingers when thrust up through the holes of a spear-palm like the Santa Barbara restoration, that they seem to have been made to replace them, as if to receive a spike at the butt of the spear, and thus enable the warrior to reserve the strength of his whole grasping hand for gripping and bracing the spear in close work or in projecting it far and with force when he would hurl it at the breast of the foe (Fig. 26). With this in mind, one sees, too, on re-examining the specimen, how the rings fit the fingers exactly for such use, and how they, and the prongs also, show wear only inside, where they should be worn if used as I have supposed. Finally, in the ornaments of

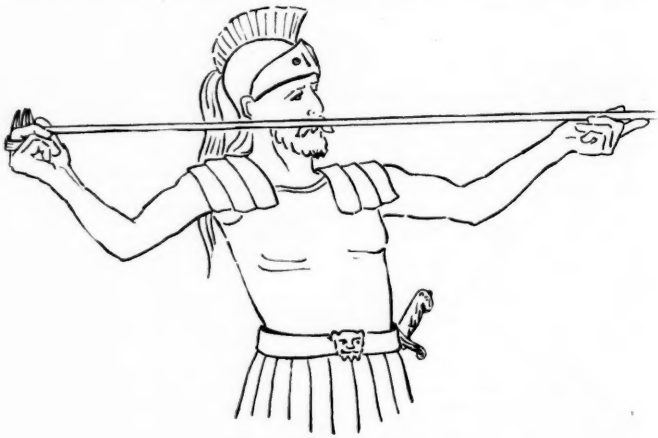


FIG. 26.—Spear-clutch throw.

the particular specimens I have examined, one can see plain survival of the double-bent bands, the knotted fastenings of rawhide, and the prongs, of horn or bone, with which like spear-clutchers might have been made long before the age of bronze.*

* Discussing this and my succeeding paper at the recent meeting of the American Association for the Advancement of Science, in Springfield, Professor Morse questioned the soundness of my theory regarding the primal use of these so-called "bow stringers" or "stretchers." Referring to the great number of such relics which he had examined and sketched, he called attention to the fact that on some of them the prongs were replaced by mere knobs or protuberances. He further argued that such use as I assigned for them, although so important, was nowhere mentioned in classical writings.

In replying, I stated that even this later or bronze form of the objects in question was in the two specimens I had examined so perfectly adapted to the fingers for use in

Yet these early kinds of spear-palms and clutchers, while giving secure grasp and great power in the holding or hurling of heavy weapons, did not greatly increase the distance of their flight. So long as they only were known, there still remained the superiority of the long-armed thrower. But let us suppose that

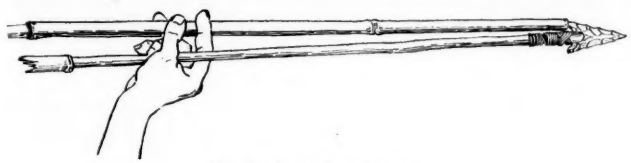


FIG. 27.—Throwing with spear.

a man holding an extra spear in the hand (point backward) with which he hurled another, happened now and then to catch the butt of the one thrown on the barb of the one held (Fig. 27), he would not fail to find that this gave great additional force to his cast. I conceive that it was thus, or in some like simple

FIG. 28.—Throwing with throw-spear.

way, that it was found expedient to lengthen out, backwardly, the rear- or finger-end of the spear-palm, if the spear-palm had come into vogue before that, and if not, to make an imitation

powerfully clutching and casting, say, a spear, that I was inclined still to believe even the knobbed examples he graphically sketched for us could well have served such purpose, or may at least have outlived such use originally in somewhat analogous uses. I would add also that while classical writers do not, indeed, expressly mention, so far as I know, the use of these bronze articles at all, nevertheless some of them, notably Xenophon in his Anabasis, do incidentally refer to straps and other devices for flinging spears, in connection with which these pronged and knobbed rings would have served admirably.

Be all this as it may, the general argument of the paper is not materially affected by this single illustration in it. I acknowledge that the small number of specimens I have studied, though typical, hardly afford basis for more than a suggestion as to their use or derivation, and I am grateful to Professor Morse, therefore, for his words of caution.

throwing-spear, so to call it—a mere spindle or flattened shaft with a barb or hook at the end of it, like, for example, the throwing-sticks of the Australians (Fig. 28). The spear-throwers of the Eskimo (Fig. 29), so instructively classified and described by Professor Mason in his paper on "Throwing-sticks in the National Museum" (Report of the Smithsonian Institution, 1883), are regarded as the most highly developed forms of that apparatus in the world. They certainly are the most elaborate; beautifully shaped to fit exactly the grasp of the throwing hand, and are provided with effective shaft-grooves and butt spurs or catches of ivory or bone. But there are some peculiarities of these throwing-sticks which relate them apparently to an undeveloped form,—quite directly to spear-palms somewhat like those of Santa Barbara and their greatly lengthened out descendant, such as is figured and described by Professor Mason (op. cit.) as having been found in use and collected near Lake Patzcuaro, Mexico, by our well-known, scholarly, and indefatigable writer on anthropology, my friend, Captain John G. Bourke, of the United States Army.

On examining any typical collection of Northwest-coast throwing-sticks, or the illustrations of Professor Mason's paper relative to those of the National Museum, one will be surprised to note how many are marked or grooved down the backs or under sides (Fig. 30). The grooves, thus placed, have no apparent use; were put there, evidently, for some traditional or notional reason. In other words, they would seem to be survivals, for some are mere scratches, and all lead either directly from the finger holes or pits (or else from the side on which these or their substitute clasping notches or pegs occur) to the spur insertion or to beyond, being always painstakingly cut or scratched into or across the base of this hard ivory spur-block.

It is this groove particularly which appears to relate these sticks to one of the earliest forms, the palm-and-finger form (like Fig. 23), for they seem to be survivals of the finger-groove, lengthened out, perhaps, to accommodate the string, which was held noosed to the backwardly bent middle or fore finger and extended to the end of the stick, there to hold the butt of the spear or catch thereof until a bone finger (artificial finger-nail, as it were) was inserted, after which, as was fit in savage use, the groove was kept as a channel from the finger end to this extra end or nail, as a

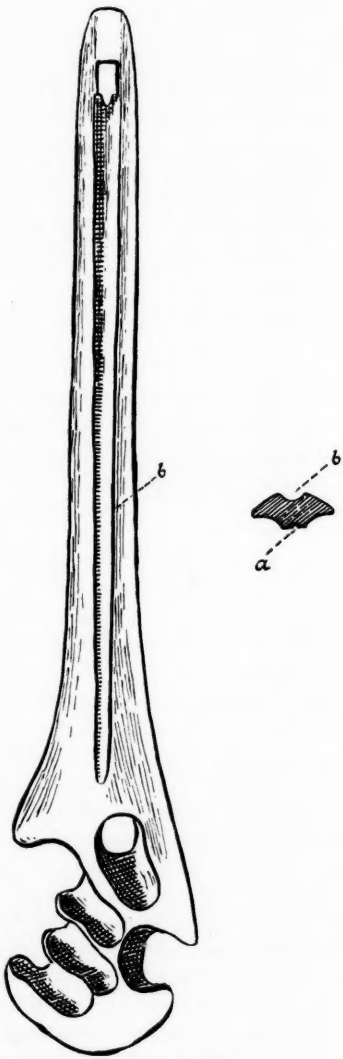


Fig. 29.—Front of Eskimo spear-thrower, showing shaft-groove and spur (see also section).

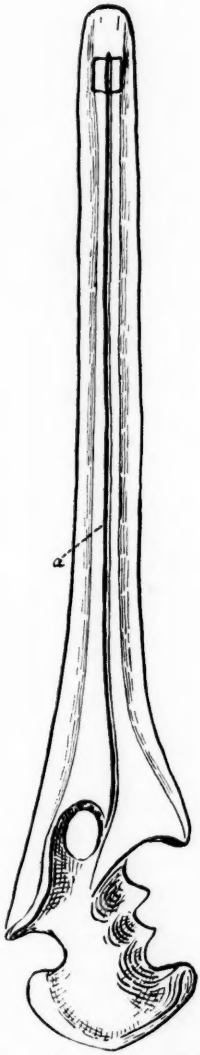


Fig. 30.—Reverse of Eskimo spear-thrower, showing back groove (*a* in figure and section).

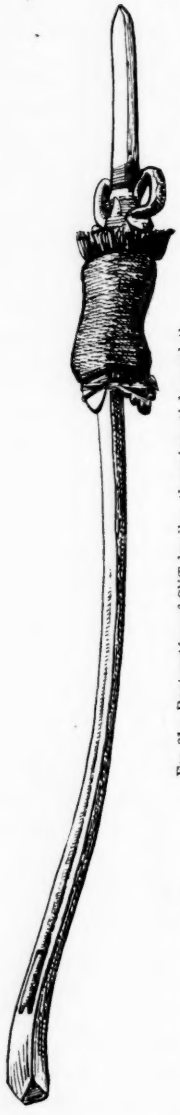


Fig. 31.—Restoration of Cliff-dweller throwing-stick or atlatl.

"way trail," so to say, through which the strength of the forefinger might reach the spear-butt or catch. I would like to refer to some examples of this groove as having probably been transferred in turn even from the throwing-stick to later forms, when these displaced its supremacy in use, as may be seen on certain bow-arms of the northwest region, the bellies of which are quite as uselessly grooved from grip, to horn or nock.

The element next higher in the development of the dart-flinger is not present, however, to any great extent, in the Eskimo forms, but it is to be found very decidedly exemplified in the throwing-slat or atlatl, quite independently identified by Professor Mason and myself in the remarkable Cliff-dweller collection I have before referred to.

Through the courtesy of my friend Mr Stewart Culin, Director of the Archeological Department of the University of Pennsylvania, I have been enabled to study out experimentally the original form of this interesting flinging-slat or -stick, and to reproduce it in its original condition, accurately and in working form. This little apparatus (Fig. 31) is made from a very slender and flexible sapling, of light and springy but hard wood, such as the Cliff-dweller bows were made of, the half or one arm of the more finished sort of which it almost exactly resembles—that is, the small handle is straight or slightly upturned from the ingeniously attached, spectacle-like finger loops or rings of hide, and thence toward the spur end it curves first downward, then rather sharply upward to the groove, which is short and shallow, and to the terminal spur-sink,

which is only an inch or two long and is relatively deep. Thence to the end, a couple of inches more, the stick is curved down again so as to throw up the spur or catch and the little groove at the end of which it is cut; and thus the whole in profile and upside down resembles the arm of a Cupid's bow, save that the end or "horn" is thick.

Just above the handle and finger-loops is a heavy binding, first of sinew, then of yucca fiber, lastly of brown yarn, which at the outer end firmly seizes to the rounded (or under and back) side of the implement a fragment of beautiful black slag or limonite—the blood-clot of giants slain in Creation time with lightning of the gods of war, according to Zuñi lore. On the opposite or flat,

Fig. 32.—Cliff-dweller atlatl or throwing-stick in use.

upper, and front side, also at the outer end of the bindings or packings, a beautifully ground and polished chalcedony knife-blade (the tip only of which protrudes) is bound on and probably served to divide the feathers, or as the "father of lightning" (to increase which it was doubtless ground at night), precisely as the lightning knives of the Zuñis are on their badges of war. Finally a little tusk of the wildcat is inserted into the packing on the same side, its protuberant point laid close against the finger loop, strap, or fastening, so as to hold it from slipping. I find that originally feather-work was whipped into the surface of the packing near either end—of red, yellow, and blue

plumage, probably taken from the jay and the red-headed woodpecker of the south or from humming-birds. All this was both fetishistic (the life portion of the flinger) and to brace the knuckles so that the spear could be easily held high when flung. Thus the shaft of the dart did not lie along the upper face, as in other and long-grooved examples, but merely touched the counter-sink near the spur or catch at its end. As the result of this method of release and of the curved and flexible style of the flinging-stick, the spear or dart could be sped with a spring, which added so greatly to its force that with my reproduction of the cliff specimen I can throw the harpoon twice as far (Fig. 32) as with my Eskimo specimen, with less trajectory and hence more accurately.

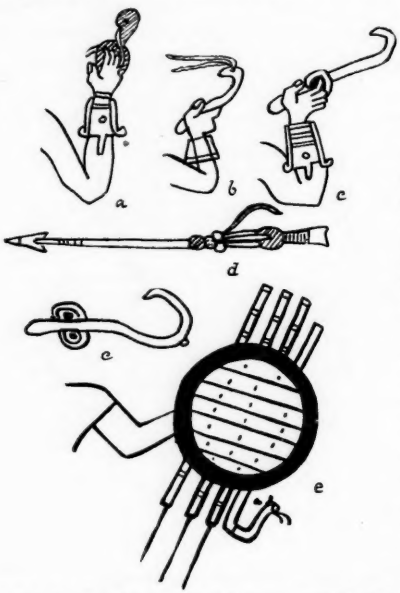


FIG. 33.—*a*, Maya representation of crozier-form atlatl held close, with strap, for throw; *b*, ditto, released, straps flying (Dresden Codex); *c*, *c*, Maya and Mexican crozier-shaped throwing-sticks; *d*, Maya spear with holding strap; *e*, ancient Peruvian sheaf of darts, shield, and symbolic throwing-crook (from Chimu vase painting).

Among a people armed with such effective flingers, I do not wonder that their use survived that of the bow, even away from the appropriate habitat of the spear-thrower—the water side; nor need one wonder that the famous atlatl of the ancient Mexicans, made famous anew by the amazingly convincing and beautiful study of it Mrs Zelia Nutall has given us in the first volume of the Archeological and Ethnological Papers of the Peabody Museum (Harvard University, 1891), and which atlatl is, I belive, the lineal descendant of this one of the Cliff-dwellers, feather-work, fetishistic element, and all; nor that it should also

have been even more highly valued for special purposes by the Aztecs than was the bow, for in its many southern forms, as figured by Mrs Nutall, are to be found still higher developments. I refer especially to the crozier-shape ones and to those "with straps" (Fig. 33, *a*, *b*), recalling Fray Diego de Landa's most significant description of the Maya forms seen by him in the sixteenth century.

Now, the crozier-shape or bent form of the spear-flinger (Fig. 33, *cc*, *e*) was, as my experiments have indicated, a veritable combination of the bow and the spear-thrower. In it the spring of

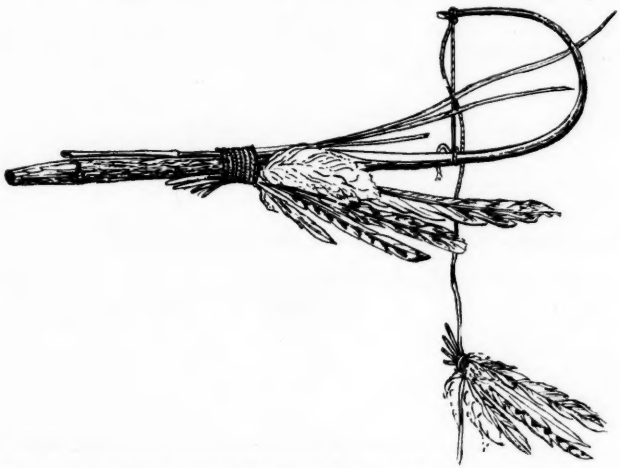


Fig. 34.—Zuñi plumed prayer-stick of war sacrifice, or "Bearer of the reed of war."

the bow already appears. It is simply a stringless bow, used backward, while in the still more elaborated form of it, that of the Mayas, the string also appears, only it was loose at one end (Fig. 33, *a*, *b*) or else attached to the spear-shaft itself (Fig. 33, *d*), as shown by the plates in the Dresden Codex (which has opportunely been sent me within the last two weeks by that generous patron of anthropologic research, M. le Duc Loubat). Were I uncertain of the meaning of these forms I might be reassured by certain evidences furnished by the Zuñi. The Zuñi still have traditional knowledge of the use of the spear-thrower and its appropriate hoop or net shield by their cliff-dwelling ancestry;

and the truthfulness of their vague traditions is substantiated by certain survivals among them. One of these, as exemplified in certain spear and ring games, I shall refer to in the following part of this paper. The presently significant one is apparent in their little crooked or crozier-shape prayer wands or staffs. Some of these are actual staffs in miniature, and symbolize the prayer journey and a number of other things; but the warrior and hunter symbol and sacrifice of this shape, differs from these in being supplied with a holding string. It consists of a split twig about a foot long, the upper end of which is bent far over, like the head of a shepherd's crook (Fig. 34), and tied at right angles to the main part of the shaft with a taut string, on the middle of which is a double knot or a dab or two of black paint.

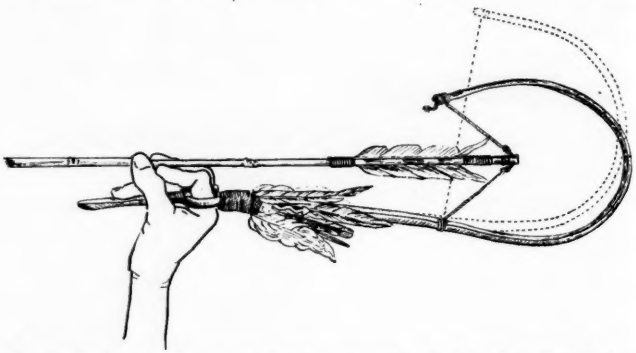


FIG. 35.—Restoration of ancient stringed spear-crook or throwing-bow (from Zuñi prayer-stick of war).

It is plumed on the handle portion or near the base, and attached to it inside, so as to lie along it and against the string at the "knot" or paint dab, is a sprout or stem of cane or reed-grass. If this little "carrier of the cane" or "war-staff" be but enlarged or restored (as I have experimentally restored it) and used with a notched spear-dart like those of the Dresden Codex, with or without straps, and if then the missile be pressed back against the string and held with fingers (or by its strap) until released with a fling, the rebound of the string, as well as the spring of the flinging-staff, adds treble velocity to it. And it seems to me that the steps are few and short from this already strung but reversed flinging-bow (Fig. 35) to the bow of archery.

That such steps were actually taken, not in one land and by one people alone, but in many lands and by many peoples (and from differing forms and styles of throwers to differing developments of the bow), can, I think, already be shown. In the first place, the Zuñi name for the bow is significant. It is *pi'-'hlan-ne*, from *pi'*, "a string" or "stringed" (emphatic form); *'hlam*, "a slat," "stave," or "staff," and *a'-ne*, "to go," or *a'n-a-ne*, "go-thing"—that is, "a stringed go-staff" or "stringed *go*-slat." "To

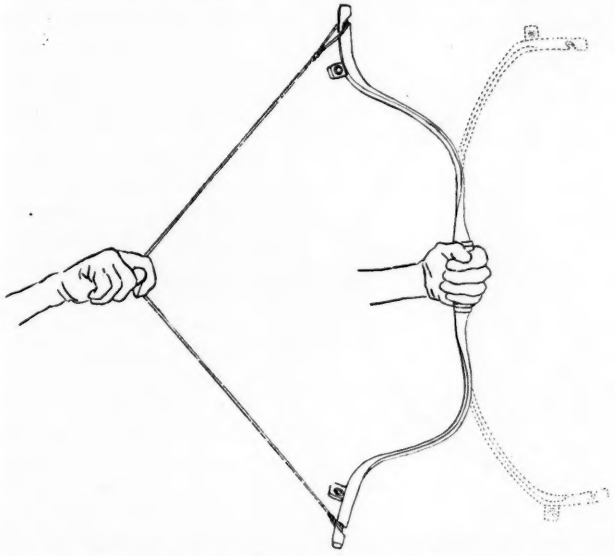


FIG. 36.—The "Tartar bow," as drawn, released, and reversed when braced with slack string.

shoot" (with an arrow) or "to hunt" is *'hala'-ta*—that is, "slat-direct" or "staff-aim"—whereas the name for an arrow is *sho'-o-le* ("cane" or "reed"), and is not, it will be seen, referred to in this etymology. Again, to hit or pierce with an arrow is *'hlat-k'u*, from *'hla'm*, "a staff" or "slat," and *t'e-k'u*, "to stick into"—that is, "to slat-stick" or "slat pierce," in the sense of piercing or sticking into from or by means of, not with, the slat. Now, all these terms, especially the latter two, were formulated, I take it, from use of the throwing- or flinging-staff, not from use of the bow in its

later form; and they would indicate that with the Zuñi ancestry, at least, the throwing-stick both antedated and gave rise to their later present form of bow. Of this there is far more additional evidence than I can offer here. Nor can I enter into the intensely interesting results of my experiment study of Mexican and Mayan forms of the throwing-stick, all indicating even more strongly the same thing, and indicating also the directness of derivation from our own great southwest, of art elements, at least, in these old cultures of the south. I must, on the contrary, turn a few moments to other lands.

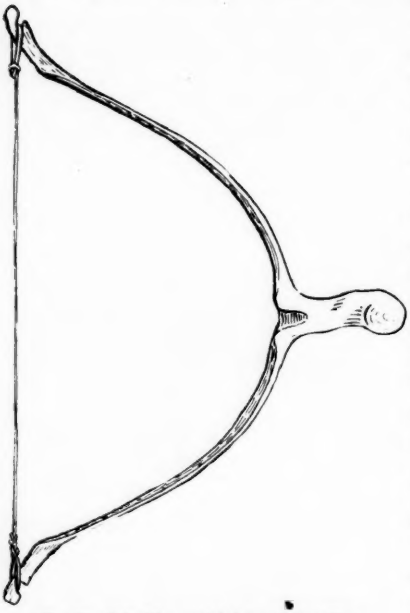


FIG. 37.—Primitive crotch-bow, wide antlers.

In old world countries, language tells much the same story in, for example, Chinese and Korean terms and characters, according to Mr Culin's profound studies of these peoples and their languages, and in the Arabic,—of which that brilliant and universal scholar, Dr Talcott Williams, tells me archery terms are apparently quite as dissociated in derivation from an original use of the bow with the arrow as are those I have above analyzed.

When talking on this subject with my lamented friend, the artist, Thomas Hovenden, who went to his noble and heroic death but a few days ago, he did not at first understand and quite believe in my theory, but pushed a canvas toward me, and handing me a charcoal stick, bade me draw the form of thrower I then thought was the connecting link between flinger and bow. I

drew one—a long, slender twig, with a fork at the end, and a string attached to the crotch, both for catching the spear and for bending the stick to give it spring when loosed. He looked astounded for a moment, then delighted. "Do you know," said he, "that as a boy I played with such a sling-stick as that, as other boys commonly did when bird hunting on the Irish marshes;" and in the morning he made me one. It was my hypothetical connecting link between spear-flinger and bow.

Dr Williams informs me also that when he was a boy the young Indians of central New York used some such apparatus, half

Fig. 38.—Mode of bracing and releasing bow-crotch.

toy, half weapon, and that his father once made one for him. You are all familiar with the dart-springing stick, which is stuck in the ground and while held by one hand is pulled back by the other to fling the dart. Certainly every one is acquainted with the "slap-jack," destroyer of so many window-panes in school-rooms and on city streets. You approvingly remember also, I hope, what I have said on an earlier page, of toys; but I wish to explain for a moment the development of a throwing-crotch resembling these things, in a part of the world where its study serves to ex-

plain more than merely the origin of its appropriate form of the bow. I refer to the vast area of the so-called "Scythian" or "Tartar bow." Any one who examines one of these extraordinary bows, and especially who notes the manner of its use, will not find much difficulty, it seems to me, in tracing it back to what appears to have been its ancestral form in a simple forked twig or flinging-crotch, the steps are so obvious and few.

The Tartar bow (Fig. 36) is a built-up bow, excessively flexed, not toward the belly, as are bows usually, but toward the back, its ends or horns being still more backwardly flexed, so that they even approach each other when the bow is slacked. The string-nocks are deep and slanting, and at the base of each horn or ear is attached, on the belly side, a bone or other hard block, chiefly to catch or slip the string when rebounding, but pierced trans-

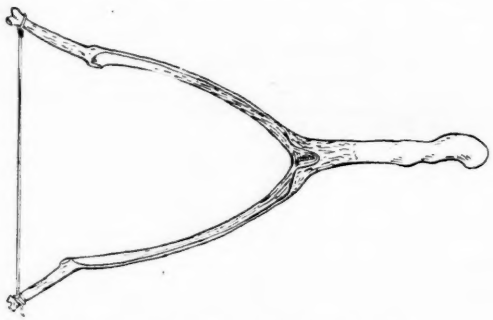


FIG. 39.—Primitive bow-crotch, narrow antlers.

versely in some specimens. Through these blocks the ends of the string used sometimes to be passed from one side before being noosed to the nocks or else it was knotted one-sidedly to the nock of the upper arm. Thus when the bow was drawn, not only were the arms reflexed more than twice as far by a pull of but the same distance to the rear of the grip or bow-hand than they would be on the ordinary bow, but the string pulled more to one side than the other, so that the curious overhand release sometimes observed among Tartar, and, I am told, some other Mongolian tribes, was not only facilitated, but in these cases was rendered inevitable. Thus an arrow was half shot, half flung, or

cast from such a bow, and it is this which makes the thumb-ring pull and the overhand release natural and which challenges our attention; for the motion of the release (Fig. 36), no less than the form of the bow, seem both to have been directly derived from a wide-antlered, two-hand dart-flinging crotch (Fig. 37)—half slinger, half bow—which probably suggested a still wider-armed, spliced and haftless crotch or bow, and thus almost immediately preceded it in development. With such a crotch, if stringed between the two antlers or branches and grasped in the left hand by the handle at their base or juncture, while with the thumb of the right hand the string was drawn back—the dart meantime being held thereto with the fingers of the same hand and thus braced for release (Fig. 38)—one can see that with a sharp fling the dart would be discharged over the crotch and the string fly over the bow-hand, much as it does in the Tartar bow-release, so to call it. This form in turn is but an improvement on the one less spread and depending on both outward and forward release-spring in its antlers (Fig. 39); and this, finally, is but little better than one in which the spring of its still less separated branches was forward alone, and was its sole advantage over the long-branched and flexible but one-handed throwing-crotch (Fig 40, *a*), recalling in some ways the unrelated Celtic form my friend Hovenden made, and the primal short-branched sling-crotch (Fig. 40, *b*) in which it would seem was the germ of this peculiar sort of built-up and compound ancestor of the Mongolian bow.

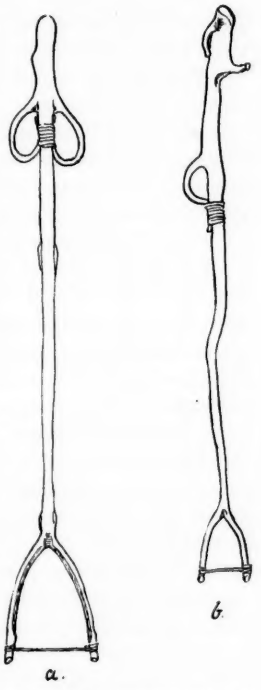


FIG. 40.—Dart-flinger crotches; *a*, developed form; *b*, early form.

[TO BE CONTINUED]

THE BEGINNING OF AGRICULTURE

BY W J MCGEE

The following pages record a few observations and generalizations made incidentally in the course of an expedition through the little-known region in Arizona and Sonora (Mexico) called by Spanish-Americans "Papagueria," or land of the Papago Indians. The primary purpose of the expedition, which was made under the auspices of the Bureau of American Ethnology in conformity with plans of the Secretary of the Smithsonian Institution, was the making of a collection representing the arts and industries of the Papago Indians. In part the observations recorded herein pertain to subjects concerning which no expert knowledge is claimed; in so far as they relate to plants and animals they are merely such as any intelligent traveler through a region of pronounced peculiarities might be expected to make;* but the observed relations of plants, animals, and men, among each other and to their common environment, were studied with care and generalized with some fullness. Throughout the expedition the question as to the influence of a peculiar environment on mankind, individually and socially, was constantly borne in mind; and it was this question that directed the observations and generalizations. The principal conclusion is in accord with the opinion of Powell and some other students concerning primitive agriculture, but the generalizations and inferences are independent, and the line of induction is new.

CHARACTERISTICS OF THE REGION

Papagueria is an indefinite territorial unit varying with the migrations of a nomadic people, and thus with human whim and seasonal succession. In a general way, it lies south of Gila river in southwestern Arizona, west of the great Sierra Madre of western Mexico, and northeast of the Gulf of California. Its northern

* It is a pleasure to acknowledge obligations to Mr Wm. Dinwiddie, the photographer of the expedition, for excellent photographs of the plant forms referred to, and to Mr F. V. Coville and Dr J. N. Rose for identifying several species therefrom.

and eastern limits were originally fixed by interaction against the Apache and other predatory peoples, or rather by an assemblage of geographic conditions involving the presence of water in sufficient quantity to maintain hunter and robber tribes; the western boundary is the limit of habitability to *the* desert-loving tribe, par excellence, of North America; while on the south the land of the Papago merges into that of the Opata, Nevome, and Yaki or abuts sharply against the domain of the bloody Seri. From the Gila on the north to the rancherias beyond Rio Sonora on the south, Papagueria measures some 400 miles; on the international boundary it is nearly 200 miles broad, narrowing southward; the area in round numbers may be 50,000 square miles.

From the foothills of a massive mountain range the land of the Papago slopes southwestward as an undulating plain with many minor mountain ranges rising sharply from its surface along lines generally parallel with the great Sierra. Streams gather in the Sierra and in the higher embossed ranges, and the larger of them flow in the intermontane valleys northward and southward from a subcontinental divide coinciding closely with the international boundary; but in their middle or lower courses these stronger streams trend southwestward across the valleys and athwart the axes of the minor ranges toward the Gulf of California. The great streams heading in the Sierra Madre—"Mountain Mother [of waters]"—carry vast floods in their middle courses during the rainy seasons, while at ordinary stages they are but slender brooks; and between the Gila-Colorado and the powerful Yaqui (the Indus of Mexico, whose far-reaching affluents with their hundreds of tributaries drain most of the high Sierra) even the freshet waters are absorbed by the dry air and the thirsty soil, and none of the rivers reach down to the sea. The smaller streams are more erratic in direction, but the smaller and the larger are alike in general character; all head in the mountains and, gathering volume from tributaries, flow along or athwart the intermontane valleys for longer or shorter distances, and then dwindle or disappear as the waters evaporate or sink; for a few hours or days after the storms of the rainy seasons all are rushing torrents, and then for days or months they are but slender brooks or broad wastes of sun-parched sands. All the waterways are deep and rugged gorges or gulches—the "barrancas" of the Mexican vernacular—toward the sources,

broad steep-banked and sand-lined arroyos in the upper valleys, and expanded deltaform silt sheets in the lower valleys; and in all permanent streams the midlength arroyo of the upper valley is cut out and maintained by the brimming floods of the rainy seasons despite the feeble sedimentation of the narrow streamlet wandering over the channel bottom during the dry season.

Papagueria, with its western borderland skirting the Gulf of California, is perhaps the most arid region of equal extent on the western hemisphere. The annual precipitation over the portion lying in Arizona, according to the latest charts of the United States Weather Bureau, ranges from about three to something over ten inches, the maximum occurring only in the Sierra Madre on the east; the average west of the Sierra is probably less, and toward the gulf much less, than five inches. On the Sonoran side of the subcontinental divide the rainfall is undoubtedly a little greater, though trustworthy figures are lacking. Within the region the districts of January-February and July-August rains overlap, and there are thus two rainy seasons during each year. To this circumstance many of the characteristics of Papagueria may be ascribed. In the first place it is probable that if the rainfall were concentrated in a single season, the storm freshets would be greater and a part of the scant water supply would escape into the gulf, rendering the region more desert than it is; in the second place the semi-annual watering and checking of evaporation vivifies the flora and doubtless enables many plants that could not survive a ten-month drouth to maintain themselves—certainly the semi-annual rain is a condition to which the vegetal and animal life is adjusted, as shown by the two seasons of leafing and flowering of different forms.*

The higher ranges near the Sierra are thinly clothed with pines, oaks, and their associates; the larger foothills as well as the lesser ranges and the higher portions of the intermontane plains are still more scantily mantled with cactus, yucca, agave, several mimosas, acacia, paloverde, and meager thickets of chaparral; many of the great alluvial aprons which characterize this region of subaerial planation are given over to cacti and related plants of many genera and species, with scattered stems of grasses and occasional

* Johannes Walther has shown that the flora of the American deserts is richer than that found in the deserts of the Eastern Hemisphere. Nat. Geog. Mag., vol. iv, 1893, p. 166.

tufts of greasewood and rabbit-brush; the intermontane valleys are sparsely dotted with mesquite and related mimosas, and an occasional paloverde and the creosote bush in season, intervening with vast treeless glades supporting nothing but widely scattered blades of silver grass, or with stretches of greasewood and other prickly shrubs; while the barrancas and the midlength arroyos of permanent streams are flanked by cottonwood, willow, giant mesquites 40 to 75 feet high, sycamore, ash, and other trees, with a rank undergrowth of shrubs, grasses, canes, and vines, all growing in tropical luxuriance. Viewed collectively, the flora is fairly rich in species, wretchedly poor in individuals; by reason of the vegetal extravagancies of cactus, agave, yucca, and aberrant tree-type, the flora is multiform when individuals are viewed, but by reason of a prevailing tendency in the differentiation of distinct types it becomes monotonously uniform when viewed collectively. Leaves are lacking or small and close-folded; stems and trunks are prevailingly gray-green and waxy, and thorns abound on all the floral forms; yet, though many mountains are almost barren and many valleys are nearly bare, vegetation is never totally absent save from a few shifting sand wastes and the coastward malpais—the "bad land" of Mexico.

The animal life is largely nocturnal and crepuscular, and the day traveler sees little of the fauna. The most conspicuous animate creature, by reason of its works and the number of individuals to be seen, is the farmer ant, whose well-kept fields and clean threshing-floors dot the great alluvial aprons and some of the higher intermontane valleys by tens of thousands—indeed, a quarter, if not a third, of Sonoran Papagueria has been reclaimed by these thrifty husbandmen for their own uses, so that a full half of the grass to be seen in a day's journey is that which the farmer ants have, apparently, cultivated and fertilized. In the lower valleys, along with the scattered mesquites, the southwestern ground squirrel abounds; in the annually flooded deltas, as well as along the mountain slopes, the California quail and a variety of smaller birds, with a few of larger size, are found; hawks and, in Sonora, eagles are often seen, while the jackrabbit and coyote are never far away; lizards, bright-colored and somber, are hourly in view; the horned toad is seen now and then; spiders, including the tarantula, are plentiful save in the driest valleys; scorpions are common, and in some localities rattlesnakes abound.

Though the diurnal fauna is rather meager, it is probable that the fauna as a whole is, like the flora, fairly rich in species though poor (yet hardly so poor relatively as the flora) in individuals.

CHARACTERISTICS OF THE VEGETAL LIFE

Perhaps the most conspicuous feature of the flora, except on the higher mountains, is the dearth of foliage. The distinctive desert types—cactus, yucca, agave—are leafless. The mesquite, the prevailing arboreal form, is indeed leaf-bearing, but away from the naturally or artificially irrigated valleys the leaves, always small, are so reduced in number and size as scarcely to conceal the twigs and branches, and during the long dry seasons the oppositely arranged pinnate laminæ are so closely folded as to display little verdant surface; the greasewood (*Atriplex* of several species) and rabbit-brush are also small-leaved and their foliage, like that of the mesquite, folds up or falls off during the four-month drouths. Most of the paloverdes are leafless throughout the greater part of the year, some of them are said to be always; and whole acres of chaparral are almost entirely leafless during the drier months, displaying only a greenish gray or bluish brown wilderness of trunks, branches, thorns, and naked petioles. Even in the valleys where the trees drink from the sands below rather than from the air above, and where trunks, stems, and fruits are luxuriant, the dry-season foliage is scanty and the leaves are folded or rolled in such manner as to present a minimum surface to the air and to view—the pinnate leaves fold along the midrib, the palmate leaves of the sycamore roll themselves into slender cylinders, while other trees shed a part of their leafage soon after the end of each rainy season, to send forth a fresh foliage with the beginning of the next. Away from the watercourses the smaller shrubs are leafless brambles; and even the grasses are strong-stemmed with short and narrow blades. The humid lands of the lower latitudes are clothed with the foliage of trees, grasses, and other annual and perennial plants during most of the year; but in Papagueria, as in other semi-desert regions in some measure, this mantle fails and the land is naked or at best thinly veiled by earth-colored stems and branches, so that the plains and hillsides are more barren in appearance than in reality and often belie their own fertility.

Nearly as conspicuous as the absence of foliage is the presence of aberrant types, chiefly of robust, pulpy forms, peculiar to the desert. The great saguaro (*Cereus giganteus*), rising 20 to 60 feet in a single stem 1 to 3 feet in diameter or in a massive candelabrum, bare in the distance as a carved monolith, is the dominant form; and its huge waterlogged stems, ghostly grayish by night and ghastly greenish by day, are unlike the typical plant forms of the earth and impress the traveler as incongruous with nature. In Sonora the congeneric pitahaya abounds; with its great curved branches, each a tree-trunk in size and a mushroom in texture, it is nearly as extravagant in comparison with typical plant forms as the saguaro. Over the lower plains the closely related and equally monstrous cina (*Cereus schotti*) takes the place of saguaro and pitahaya, and dominates the shrubbery. The okatillo (*Fouquiera splendens*) with its bare, wide-branching stems approaches somewhat more nearly, and the tree-okatillo (*Fouquiera spinosa?*) still more closely, normal arboreal forms; but the nopal and nopalito (*Opuntia*, different species of the flat-stemmed type) are no less aberrant, though less conspicuous than the saguaro. The cholla (*Opuntia* with cylindrical and prismatic stems) and other arborescent cacti are fairly congruous with trees and shrubs in general habit, though not in texture, and thus contribute measurably to the strangeness of the landscape. The agaves and yuccas are only less striking than the cacti; and the pale green, bare-branched paloverde (*Parkinsonia torreyana*), with slender needles or minute pinnate leaves in lieu of normal foliage, is hardly less aberrant. This assemblage of incongruous plant forms gives character to the desert landscape.

Another conspicuous feature of the flora of Papagueria, like other desert regions, is the abundance of thorns, with which nearly all the plants are beset. The saguaro and pitahaya and their kind are armed with lines of chevaux-de-frise extending from base to summit; the nopal and the cholla are set with wide-branching bunches of barbed needles; each branch of the okatillo bristles with a thousand spines, and the water-bearing visnaga (*Echinocactus wislizeni lecontei*) is crowned and clothed with an impenetrable armor of natural bodkins and fishhooks. The yuccas and agaves abound in serrated and plain knife edges, and in many species the needle-tipped and spike-fringed fronds turn outward and downward in serried armature. The chaparral is

a wilderness of thorns; the dwarfish oak trees on the mountain sides are beset with needle-pointed knobs; the mesquite and smaller mimosas on the more arid plains bristle with thorns, and during the dry season the shriveled and case-hardened petioles are transformed into cruel spikes; the greasewood and other shrubs are crowded with irritating spines and bristles, and even the mild-aired paloverde is armed with pointed and sharp-edged processes. Certain ephemeral plants that spring up about the burrows in the shadow of the mesquite trees have holly-like thorns at the serrate leaf-tips, and the grass blades are knife-edged and needle-tipped, while the seeds are enclosed in spiked hulls or fringed with spiny awns. In all the land of the Papago there are few indigenous plants that are not armed with thorns or spikes or spines, or all combined.

The thorniness of the desert plants is associated with a peculiar modification of the surface of stems, leaves, and fruits, often in the direction of cutinization, sometimes in the direction of hairy coverings.* From root to terminal twig the paloverdes are glazed with a resinous epidermal tissue; the pulpy stems of the saguaro and its congeners are enclosed in a thin but strong waxen skin, grading into the natural lacquer coating the spines; the mature leaves of the arborescent flora on the mountain sides and along the waterways alike are thickened and harsh rather than velvety of surface, and many appear to be coated with natural varnish; a few trunks are rough-barked, but usually the branches and twigs are smooth and case-hardened. The seeds of the saguaro imbedded in the pulp of the fruit are hard and shining of surface; the mesquite beans are firmly implanted in woody pods, yet are smooth and hard, and the smaller mimosa over the Sonoran slopes bears beans in a thin-walled pod that are as hard and glossy as lacquered lignum-vitæ; and the fruits and seeds of annuals are so hard as to form a favorite material for beads among the Papago women and children. Many of the shrubs bristle with a stiff pilage from root to petiole, and sometimes the leaves are hairy or coarsely furred, particularly as the moister season wanes; and many of the bristles are barbed and brittle, and hardly less forbidding than the thorns and spines.

Another noteworthy characteristic of the plants of Papagueria is the green color of the stems and trunks. In humid lands the

*The hairiness of the desert plants has been noted by Coville in Death valley.

foliage is green, the trunks and stems generally gray or brown or black, the grasses green throughout, while in the arid regions, where the foliage is largely lost, the verdure pervades the permanent body of the plant; the nopal may become purplish or yellowish and the okatillo gray or brown, the trunk of the cholla may turn dark brown, but in all there is an element, and generally a predominant element, of green, and when the setting sun reddens the chance cloud banks even of the dry season the complementary green of the cacti-clothed landscape becomes almost brilliant. The yuccas and agaves are green, greenish gray, or greenish yellow, yet never without the element of green; the paloverdes are a soft and sickly green from root to topmost twig; all of the minor and many of the main branches of the mesquite and chaparral are tinged with green; the creosote bush (*Larrea tridentata* or *mexicana*) is a dark rich green, especially during the winter months; even the silver grass is seen in the reddened rays of the setting sun to show a greenish shade. The predominant tone of the desert landscape is gray, the color of bare earth and rock; but there is a strong undertint of green coming from the tenuous veil of stark and thorny albeit leafless vegetation.

In much of Papagueria these features are partially masked and the landscape transformed during the rainy season. Even a casual dry-season storm produces a decided change: The pinnate leaves of mesquite and paloverde and smaller shrubs open and fresh leaflets appear, and the foliage-bearing plants partially eclipse the cacti; in the arroyos the willow and ash leaves expand to their widest, the sycamore leaves unroll, and the yellowish green foliage of the cottonwood brightens; with the expansion of the old leafage and the burgeoning of the new the prevailing thorns are concealed; the desert varnish softens and stretches with the growth of trunks and branches; the silver-gray grasses assume a greener tinge, and in the general verdure the sickly green of the cacti and agaves pales by contrast.

The seasonal changes no less than the dry-season characteristics of the desert flora suggest a meaning for the assemblage of distinctive features. The seasonal changes indicate that certain features, like the dearth of foliage, are partly, perhaps largely, individual or on'ogenic; while the persistence of certain features, such as the development of aberrant forms, the permanence of thorns, and body verdure, appear to be essentially phylogenic.

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The chief function of the leaf is transpiration; but in the heated air and long drouth of the arid land a constantly transpiring plant soon withers and dies. So it would appear that in some way, through the law of natural selection, plants of luxuriant foliage have been eliminated (save along the lines of abundant groundwater), leaving plants of scanty foliage to dominate the soil. Moreover, under natural selection, as it would appear from comparison either of given species or of the floral assemblage with those of humid regions, an individual plasticity has been developed whereby the functioning of the foliage is rendered periodic in an exceptional degree; and those individuals persist and leave most progeny that are best able to adjust the rate of transpiration to the varying conditions of season. The adaptive devices developed in this hard environment are many and suggestive. Compound pinnate leaves fold easily, and so plants bearing this type of foliage abound, and some, like that of the mesquite, have become so delicately adjusted to external conditions as to fold under shock even in the humid season—indeed sensitive plants abound throughout the deserts. The rolling up of the palmate leaves might almost be termed an ingenious device and interpreted as an index of high intelligence in the tree; and the prompt burgeoning of new leaves as the air grows humid and the rain comes down is an almost pathetic expression of gratefulness, and indicates a wonderful delicacy of adjustment between organism and environment. The leaf-bearing plants of Papagueria are conspicuously characterized by certain collective habits rather than by classific features; it is by means of these habits that they are enabled to survive the nearly continuous drouths; and thus while the habit is individual in expression, it is undoubtedly hereditary in the perfection of its development. The inference from the foliage-bearing trees is sustained by the facts of the development of other plant forms, like the cacti and the paloverdes, in which leaves are lacking. The cacti represent an aberrant type, but the paloverdes are trees in all characters save the color and texture of the bark and the dearth or absence of foliage; they prevail only in arid regions, and in the drier localities displace even the deep-rooted mesquite and the abstemious greasewood; and they are undoubtedly the product of a long-continued process of adaptation through natural selection to an arid environment.

The predominance of thorns may in part be correlated mechanically with the elimination of foliage, for as the lamina withers the petiole or axillary processes sometimes shrink and case-harden and become potential thorns; but the vast multiplication of real thorns cannot be so explained. An explanation appears when the relations of the plants and herbivorous animals are studied. The thornier plants are better protected from the animals, and thereby their chances of survival and procreation are enhanced. Moreover in the arid region, unlike the humid land, the struggle among species is not territorial or numeric but individual;* it boots nothing to the plant to yield ten thousand seeds where only ten young plants can be supported; and it is of no avail to a species in the unconscious effort of vegetal vitality to cover its vicinity with progeny so abundantly as to exclude other species, since the parched soil will support but a few plants, and parents and progeny alike would famish. In the humid land the species is perpetuated through multiplication of individuals, and within limits through territorial dominion; but in the arid land the relations are changed, and perpetuation of the species is secured chiefly or solely through prolonging the life of the individual. Thus the thorny armature is doubly beneficial; for it first prolongs the life of the individual, which is preëminently essential to the perpetuity of the species where only a few individuals can exist, and then increases the chances of long-lived progeny in sufficient yet not redundant numbers. These relations suggest that the desert plants should be found exceptionally long of life and exceptionally scant of seeds; and while further observation on these points is needed for demonstration, and while some other relations enter, there is reason to opine that long life of individuals and either limited numbers or small size of seeds are characteristic of the desert flora—*e. g.*, the typical saguaro bears minute seeds, though in considerable numbers, and is exceedingly slow of growth. The many adaptive devices of plant effort for wide distribution of seeds and phytons (for the cholla and perhaps other cacti seem to have re-

*Coville, speaking of the flora of Death valley (Contributions from the U. S. National Herbarium, vol. iv, p. 43), says: "It is evident * * * that desert shrubs essentially present in their environment the anomaly of a struggle for existence, not against other plants, but against nonorganic physical forces alone." This admirable report was not seen until after the expedition to Papagueria, nor indeed until after these paragraphs were written.

verted to the mode of reproduction by vegetative propagation*) must be passed over; it suffices to note that the development of a protective armature of thorns in arid lands seems to be natural and necessary and the outcome of phylogenic modification. It is significant that in the case of thorns, as in the case of scant foliage, a characteristic habit of unrelated plants rises above specific affiliations—taxonomically the flora is widely diverse, but in this as in several other characters it is singularly uniform in habit, so that the specific differentiation of the ages is partly masked by a conspicuous unification in a certain direction.

The lacquered and pilose surfaces of desert plants affect transpiration. With the cutinization of leaves the stomata are contracted or covered, with the exudation of resinous or waxy substances the twigs and trunks become coated with an impervious varnish, and with the natural lacquering of the seeds they are preserved unto the ensuing moister season when the lacquer softens and the germ quickens; the barbed bristles of leaves and stems protect them from at least the smaller herbivores, the harsh or soft pilage catches and holds the moisture from the rare rains and dews, and the pubescence measurably protects the plant against changes in temperature.† Thus it is evident that the cuticular modification of the desert plants is beneficial individually and hence phylogenically; and the noteworthy development of these modifications, like the other characteristics of the flora, may be explained as adaptations through survival of the fittest.

The cactus is essentially a reservoir of water pumped from beneath and confined by a thin yet impervious shell, protected by an armature of thorns; and though of different form, the agave and yucca are essentially similar in plan. So the aberrant plant types characteristic of the desert are most conspicuously, if not preëminently, adaptive devices for the storage and presumptively for the most effective use of water; in them the energy of the plant is mainly expended not in the multiplication and diffusion of individuals, nor in energetic growth of individuals, nor in the development of permanent structures (for the cacti are notable for their paucity of woody or other permanent tissue), but in storing a single substance against the time of scarcity that the

*Toumey has recently described the mode of reproduction of *Opuntia* in southwestern Arizona by the distribution of joints or fragments.

†The last-named function of the plant hairs is specifically recognized by Coville.

individual may maintain a lowly and feeble vitality for a long period. The roots of the pulpy desert plants are long and often large; yet when these plants are compared with the vegetal organisms of humid lands, it seems manifest that the function of the water collected by the roots and stored in the stems is peculiar—the substance appears to perform its duty not so much by flowing through, as by remaining in, the tissues. Accordingly the desert plant appears to be an exceptionally effective mechanism for utilizing the power of water, a high-power chemical engine rather than a low-power hydromotor; and the predominance of these forms may be ascribed to the selection and development of this peculiar quality through survival under adverse conditions. The phylogeny of the pulpy desert plants is obscure; but it is probable that the genera and species were developed with relative rapidity during the later geologic periods to fit the peculiar assemblage of conditions found in arid lands. Yet although geologically modern, they are in many respects allied to primitive plant types, and are in many ways antithetic to the higher types differentiated during the ages to fit the conditions commonly prevailing over the lands of the earth. Thus the forms are aberrant, incongruous with prevailing vegetation, though accordant with a distinctive set of conditions; and in the development of this accordance they have assumed the habits of leaflessness and thorniness impressed on unrelated forms by the same rigorous conditions; so that the adaptive similarities have in some respects eclipsed real homologies.

The paloverdes are enclosed in an impervious glazed skin or bark, somewhat resembling the dermal covering of the cactus and agave; their conspicuous feature, which they share with the pulpy desert plants, is the green color due to abundant and widely diffused chlorophyll. Similar coloration, though generally in less degree, prevails in the trees and shrubs of Papagueria, where twigs and smaller branches, if not main stems, are commonly greenish, sometimes clearly green as in the paloverde. Now, according to Lommel and others, and as taught by Vines,* the function of chlorophyll is to absorb certain rays of light, and thus to enable the protoplasm with which it is connected to avail itself of the radiant energy of the sun's rays for the construction of organic

* Lectures on "The Physiology of Plants," Cambridge, 1886, Lectures IX, XIII, XVII, etc.
† Ibid., p. 157.

substance from carbon dioxide and water.† Considering chlorophyll with its associated substances as an adaptive mechanism for utilizing the energy of light for the behoof of the plant in which it is produced, then it is especially beneficial to the meager flora of the desert; for not only are the individual plants so widely scattered that the solar rays reach all parts of the organism above ground level, but the insolation is much stronger than in humid lands, and is rarely checked by clouds. It seems probable, too, that the exceptionally effective utilization of water in the pulpy plants is directly connected with the action of the chlorophyll; but whether this is the case or not, the abundant development of chlorophyll in the stems and trunks of leafless or scant-leaved plants is unquestionably adaptive through the survival of the chlorophyll-bearers.

The great lesson of vegetal life in Papagueria is found in the delicate adjustment of the varied flora to the dominant condition of aridity. Some species are adjusted to the condition largely by modified habit of foliation; other species, like the paloverdes, represent profound modification of the arboreal type; while the dominant forms, cactus, agave, and yucca, represent still more profound modification of subarboreal, if not primordial vegetal types; and all of the plants, howsoever divergent phylogenically, are notably convergent in a certain group of characters, including leaflessness, waxiness, hairiness, thorniness, and greenness. By some naturalists the divergent characters of organisms are classed as natural or biotic, the convergent or composite characteristics as artificial or demotic; but under this classification the common peculiarity of the unrelated desert plants would become vegetal artificiality. This distinction need not be pursued; it suffices to note that the desert flora reveals in strong light the exceeding adjustability of even the more fixed organic types to environment, an adjustability so delicate that the affinity thereof masks and modifies consanguinity.

Great interest attaches to the Papago Indians as the inhabitants of a desert; yet the extent of the interest can be appreciated only when the exceeding rigor of their environment, as manifested by the flora of the district, is understood. Even if the Papago were not interrelated with the flora, as will appear later,

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it would be desirable to consider their relations to an environment which transforms the stabler organisms of the earth.

CHARACTERISTICS OF THE ANIMAL LIFE

A noteworthy feature of the animal life of Papagueria is the protective coloring of many of the birds, animals, and reptiles. The quail and dove are slaty-gray and not easily discriminated from the gray or ashen earth, rocks, and plants of their haunts; the coyote approaches the color of the ground with its scant vegetal coloring, and is said to change color with the seasons, becoming darker with the wet, lighter with the dry; the lizards are in part bright-colored but in part gray, brown, or leaden, and some are chameleons, changing color with their surroundings; many insects, too, display protective coloring, and some, like the mantis, have acquired twig-like or leaf-like forms. These characteristics of imitative protection are prominent, yet perhaps not more constant than in other regions.

Another feature of the animal life is the fleetness and staying power of a considerable number of animals, including the deer, antelope, jackrabbit, coyote, and certain smaller mammals, as well as the bright-colored lizards and some of the hawks. Collectively the fleetness of the fauna may be adventive rather than characteristic, yet it is of interest in connection with another feature with which it would appear to be reciprocally related—*i. e.*, the venomous character of various sluggish animals. The latter feature is one which cannot easily be evaluated by reason of the frequently absurd popular beliefs on the one hand, and the antithetic tendency to exclude all evidence of venom on the other hand. It is certain, however, that the rattlesnake, which abounds in some localities and is probably the most numerous ophidian, is both sluggish and venomous; the dull and slow-moving Gila monster (*Heloderma suspectum*) is almost certainly venomous, at least under certain conditions; the indolent but pugnacious tarantula is undoubtedly poisonous; the apathetic scorpion and the clumsy centipede are more or less poisonous; the bite of the greatly feared though lazy large-head ant of Sonora and other Mexican provinces produces festering sores, whether with venom or otherwise; there are a variety of wasps, including one of great size and slow movement, whose stings are

poisonous; in southern Sonora the local katydid is more feared than rattlesnake or tarantula, its sting being supposed invariably fatal; and there is a large body of evidence indicating that the sluggish skunk under certain conditions communicates a poison akin to that of rabies. Thus a notably large number of animals are known or supposed to be venomous; even excluding all concerning which there is reasonable doubt, the ratio of venomous to non-venomous species would seem to be large. Granting the presence of venom, it may easily be explained as the prevalence of thorns among the flora may be explained: In a region capable of supporting only a relatively small number of organisms per unit of area, the perpetuity of species is best secured by the protection of individuals. Now certain lizards, insects, and birds are protected by mimetic coloring or form, the *Phrynosoma*, like the plants, is guarded by a thorny armature, and the chameleons are shielded by a physiologic mechanism for color-change; but it would seem that venom forms at the same time a more effective and a more economical means of protection, perfected by phylogenic modification through survival.

At first blush the fauna of Papagueria displays less of modification than the flora in the direction of fitness to a rigorous environment; and this relative immunity may be ascribed to the power of locomotion, which permits animals to emigrate from the most arid sections during the driest seasons, so that the mechanism of locomotion partly replaces the static mechanism of resistance developed in the stationary plant. On closer examination it is found, however, that the immunity of the animals from desert transformation is apparent rather than real; the animals, no less than the plants, are delicately adjusted to their environment; but the modification is superorganic or social rather than organic, as in the case of plants. This faunal modification is of special interest to the student of desert tribes, in that it is a connecting link between man and lower organisms.

THE COÖPERATIVE CHARACTERISTICS OF LIFE

Although the animals and plants of Papagueria display pronounced individuality, and although some of their most prominent features are adaptive devices for securing independence, a striking peculiarity of the region is the coöperation among living

things. Along the lines of groundwater the species are measurably or wholly antagonistic to their neighbors of distinct species; but over the arid uplands and in the broad waterless valleys all plants coöperate, not only with plants of distinct species but with animals, for the maintenance of common existence. Sometimes the coöperation involves little modification and no loss of individuality on the part of the agents; this type may be called *communal:* in other cases the coöperation is so intimate that animals and plants are not only mutually helpful but so closely interdependent that neither could exist without the aid of the other; this type may be called *commensal.*

Communality.—A mesquite springs up on the plain; within two or three years the birds resting in its branches drop the seeds of cacti, some of which, like vines, are unable to stand alone; and the cactus and the mesquite combine their armature of thorns for mutual protection. Then wind-blown grass seeds lodge about the roots, and grasses grow ~~and seed~~ beneath the sheltering branches; and next small mammals seek the same protection and dig their holes among the roots, giving channels for the water of the ensuing rain and fertilizing the spot with rejectamenta. Meantime the annual and semi-annual plants which maintain a precarious existence in the desert take root in the sheltered and fertilized soil beneath the growing cactus and mesquite, and in season it becomes a miniature garden of foliage and bloomage. Then certain ants come for the seeds, certain flies and wasps for the nectar, and certain birds to nest in the branches. In this way a community is developed in which each participant retains individuality, yet in which each contributes to the general welfare. So advantageous is the communal arrangement that few organisms of the drier portions of Papagueria pursue independent careers; the vast plains are dotted with communities or colonies from a few rods to some furlongs apart, while the intermediate stretches are practically lifeless; and the very soil is molded into a succession of hillocks with bare glades between, which persist even after the extermination of the colonies through climatal change or through human intervention. Thus do a large part of the plants and animals of the desert dwell together in harmony and mutual helpfulness; for their energies are directed not so much against one another as against the rigorous environmental conditions growing out of dearth of water.

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This communality does not involve loss of individuality, which prevails throughout Papagueria—indeed the plants and animals are characterized by an individuality greater than that displayed in regions in which perpetuity of the species depends less closely on the persistence of individuals. By reason of this individuality there is a certain enmity between the animal and vegetal colonists. The small birds devour the seeds of the cactus and the squirrels nibble the beans of the mesquite, yet not all of the seeds are eaten, else a succeeding generation of birds and squirrels would starve; the spiders suck the blood of the flies and the wasps paralyze the spiders to serve as food for their young, yet not all of the flies and spiders are slain, else their enemies would famish; the hawks and eagles rend the small birds and squirrels, yet not all of the peaceful creatures are rent, else the birds of prey would perish; deer and antelope and, since the coming of white men, burros and kine crop the grass and browse on the tender twigs, yet not all the grass and young shoots are consumed, else the herbivores would suffer and die. In some respects the enmity of the colonists is more bitter than that of antagonistic species in humid lands; yet it is adjusted and developed into a marvelous solidarity under which the sum of possible vitality is increased apparently to a maximum; singly or collectively the colonies support more plants than they would be able to support without the aid of their animal associates in the distribution of germs and in fertilization; they support more insects than could live with a sparser flora; they support more herbivores than could be kept on a flora not fertilized by insects; collectively the colonies support a carnivorous fauna which could not exist if either the herbivorous things or the plants on which they live were destroyed. If the vitality of the desert were limited to any one type the sum would be reduced nearly or quite to nothingness, for few of the plants and none of the animals are independent of their communal associates. The solidarity of life in the desert is far-reaching and rises above the antagonism of individuals and species, for its strength is directed against the hard inorganic environment.

Commensality.—Over the great alluvial aprons and in other tracts of firm but not too stony soil the fields of the farmer ant abound. Where the soil is particularly suitable the farms adjoin and cover most or all of the surface over scores of square miles.

Each farm includes a clean and well-kept threshing-floor and drying-ground 5 to 30 feet across, with the passageway to the subterranean habitation in the center, and an annulus 3 to 20 feet wide of luxuriant grass, on whose seeds the ants subsist. Across these annuli run great turnpikes often a foot wide, connecting farm with farm, sometimes for furlongs. In such a farming district there is practically no vegetation except the cultivated grass; not only are other grasses and weeds kept down, but even the relatively mighty cactus, greasewood, and mesquite are apparently exterminated—certainly the prevailing plants of the region are absent from the most extensive and best cultivated farming districts. Thus the tiny formic farmers have developed an art of agriculture, have made conquest of the land for their needs, and have artificialized a plant apparently as completely as man has artificialized corn and rice; and in the process they have increased and multiplied to such an extent that they would die of famine in millions if their crop should fail, while it seems almost certain that their crop-plant would quickly die out if the cultivation and perhaps fertilization by the animals were withdrawn. Thus the rigorous environment of the desert has developed one of the most remarkable intelligences of the world, and has rendered two widely different organisms interdependent.

To the traveler the saguaro is, partly by reason of its loftiness, the most prominent element in the flora. Now the young stem of this cactus shoots with considerable rapidity as a rather slender column, at first without flower or fruit. After a period said to range from 5 to 10 years, and after a height varying from about 5 to 15 or more feet has been attained, the plant begins to bear and the rate of upward growth diminishes. Thereafter it slowly thickens and still more slowly increases in height; and in time branches start out at right angles to the trunk and soon turn upward to form a giant candelabrum. Now it is noteworthy that the height at which the saguaro begins to flower and fruit varies from district to district with the height of the local flora; in a district of greasewood and scrubby chaparral the flowering may begin at a height of only 5 to 8 feet, while in a district of vigorous mesquite the flowering may not begin until the stem is 10 feet higher. It is noteworthy also that in the typical districts the branches, if not more than 3 to 5 in number, usually spring from just below the height at which flowering began (the supernu-

merary branches spring either sporadically or above the ordinary level of the tops of the first crop), and that the branches always grow more slowly than the youthful trunk, perhaps no more rapidly than the well-grown trunk from which they spring. Thus the saguaro would appear to be in some way correlated with the surrounding vegetation, and while the correlation might be ascribed to soil differences it seems probable that the connection is more complex. On examining a large number of examples in many districts the impression is produced that the mindless aim of the saguaro, through the survival of the fittest, is first to rise above its neighbors rapidly as possible before expending energy in reproduction; that it then rests from the activity of stem-growth and divides its energy between gradual expansion and strengthening of the trunk on the one hand and reproduction on the other, yet continues slowly pushing upward until it dominates the landscape; and that when the main stem becomes extravagantly high the branches consume most of the energy of growth. A reason for this erratic behavior is found when it is observed that the flowers are fertilized by insects and that the seeds are distributed by birds; for it is manifest that the finding of the plants by flying things is facilitated by their great stature. Moreover the flowers are brilliantly white in color and attractive in perfume, while the fruit is gorgeously red and sweetly sapid. Still further it is manifest that the typical placing of branches is the most economical possible at once for the pumping of water from below and for bringing the flowers and fruits at the extremities within easy sight of the coöperating insects and birds. So it would appear that the saguaro is a monstrosity in fact as well as in appearance—a product of miscegenation between plant and animal, probably depending for its form and life-history, if not for its very existence, on its commensals. Whether the small black insects that suck the flowers and distribute pollen are wholly dependent on the saguaro for existence, like the yucca moth on the yucca (as shown by the lamented Riley), is questionable; and it is hardly probable that the birds that consume the saguaro fruit are so dependent on it as to have undergone actual differentiation of characters fitting them to the commensality.

The lesson of coöperation among subhuman organisms in Papagueria is the solidarity of life to the extent that the vital

energies of plants and animals are directed primarily against the inorganic environment, rather than against kindred and alien organisms, while one of the results of this solidarity is the development of strong individuality. By reason of this coöperation the desert was in part reclaimed and a series of superorganic organizations—unconscious and undesigned but none the less beneficial—was developed before the advent of man. In general, social and other institutions are a product of human intelligence alone; and it is of interest to the anthropologist to learn of the growth of organizations among lower organisms, and of special interest to study the effect on mankind of an environment so peculiar as to produce subhuman communality.

CHARACTERISTICS OF HUMAN LIFE

The Papago Indians are *the* desert people of North America. They dwell among the cacti, paloverdes, mesquites, and barren plains of a region in which human enemies cannot survive. They are semi-nomadic in habit; they migrate northward in spring, southward in autumn, with tolerable regularity, and remove their rancherias with the starting and failing of springs and with other changes in water supply. In the wanderings of generations they have acquainted themselves with meteorologic conditions and with every constant and inconstant source of water; thereby they have acquired an advantage over the invader, who is soon fain to retire or famish.

One of the first characteristics of the Papago to strike the observer is his capacity for abstinence: The Papago vaquero will ride one, two, or even three days without drinking, under a sun so fierce and in an air so dry that the tenderfoot dies of thirst in a few hours; and a family of a dozen often confine themselves for weeks to the contents of a single olla daily for drinking, cooking, and all other purposes. So, too, they live on reduced rations of solid food for considerable periods without inconvenience; indeed their habitual diet is moderate, even allowing for the condensed and nutritious character of some of their foods. When the interpreter was asked how the people of a rancheria were able to subsist for a winter on a certain limited supply of food, he replied, "They eat only twice a day, and if there is not enough they eat only once." The abstinence from solid food is in a measure apparent only, for the Indians are disposed to glut-

tonize in idleness when opportunity arises, when their capacity for consuming is no less striking than their power of abstaining. This characteristic of the tribe is possessed by other primitive peoples, perhaps in nearly equal degree; yet it is noteworthy as displayed among these Indians.

Another characteristic of the Papago is strength and fleetness: A withered crone (shown in the photographs of the expedition), weighing apparently not more than 80 or 90 pounds, arose from the ground with a kiho containing a stone mortar 196 pounds in weight, carried this burden more than half a mile over a sandy road, and then let it down from her back, and this without perceptible exhaustion or attracting particular attention among her neighbors. Many equally noteworthy feats of strength and endurance might be enumerated. Fleetness is displayed in the tribal game of kashâneku, or football, in which it is not unusual for contestants to run, kicking the ball before them, 30 or 40 miles in an afternoon. It should be observed that fleetness has apparently declined among the Papago since the introduction of the horse; yet they and other desert tribes have always been noted as runners: Bartlett found the Opata couriers to run 40 or 50 leagues (105 to 131 miles) in 24 hours, and Lumholz mentions that a Tarahumari Indian has been known to carry a letter nearly 800 miles in 5 days (these tribes belong to the same family as the Papago), while the Seri, who have never acquired the horse, are noted as *the* runners, par excellence, of this region of runners. Thus, although perhaps not especially distinguished, the Papago Indians are noted for strength, celerity, and endurance.

A third characteristic is apparent longevity: In every rancheria wrinkled and gray grandames and grandsires are found, generally in considerable numbers, and usually engaged in arduous labors; it is the aged woman who bears the heaviest burden, and her consort who performs the hardest field task, for the family. It is impossible to obtain exact figures concerning the age of the old people, but the proportion of the active aged is manifestly much larger than among civilized peoples. In this respect, too, the Papago is more or less like neighboring tribes, all of whom claim patriarchs and matriarchs who have far outlived the normal span of life.

Combining these and other characteristics of the desert tribe, it appears that they are in harmony with the characteristics of

the animals and plants; yet they are not so well developed as to clearly distinguish the Papago from other tribes, especially from those of other portions of the arid regions. When the physiologic or biotic characteristics of plants, animals, and men are compared it appears that the plants are most and mankind least modified in the direction of fitness to environment, the subhuman animal occupying an intermediate position.

Turning to the institutional or social aspect of the tribe, certain fairly distinctive characteristics are found, yet they are measurably masked by reason of the transition from the primitive state to the accultural condition initiated with the introduction of European crop-plants and stock. Fortunately there is a sufficient vestige of primitive culture to indicate many of the primitive customs. The Papago combined the chase for animal quarry with the search for vegetal foods; he gathered the fruits of various cacti and mesquite beans in season; he collected indurated pericarps and berries for beads; in his southward migrations he obtained seeds of corn and pumpkin as well as native beans—indeed it is probable that the primary purpose of the migration was the collection of seeds,—and on his return in the rainy season these were planted about the water holes and arroyo deltas, and in time the crop was gathered. There are indications that a tribal organization grew out of these customs; but this question need not now be pursued. It suffices to note that, as a consumer of seeds and fruits and as a distributer of seeds, the Papago entered into the vital solidarity of the desert and contributed toward the perpetuation of species that were good in his sight. In this way he made partial conquest of the soil and the productions thereof for his own behoof, and still further increased the sum of desert life; yet his conquest of the land at the time of the coming of the Spaniard was far from complete, apparently less complete than the conquest made by the farmer ant; and the historical Papago has never controlled the scant waters of his domain, but sought them where they chanced to occur in the hazard of storm and sun, just as he chased game and hunted wild fruits.

For three and a half centuries the Papago has been in contact with an alien culture, and there is evidence that during a preceding century or more he suffered through the repeated invasion

of his borders by his hereditary enemy, the Apache; thus the indigenous Papago culture can hardly be considered as independently autochthonous or indigenous—the process of culture development was undoubtedly effected by external influence. Fortunately the prehistoric remains of Papagueria throw light on an antecedent culture which appears to have been essentially indigenous; and there is reason for opining that the prehistoric peoples were the direct ancestors of the Papago and certain other southwestern tribes.

The prehistoric remains comprise greatly reduced ruins of villages and irrigation works, as well as "las trincheras" (or intrenched mountains), with included or associated pottery of fine texture and finish, and highly polished stone implements; these relics being abundant and distributed over a considerable part of Papagueria. Now, on comparing the ruins with modern artificial works (including those of the sedentary Mexicans who have pushed far into the arid district) certain important differences are found: In the first place the ancient villages were much larger than the modern rancherias of the Papago; in the second place the ruins are much more numerous than the Papago rancherias and Mexican settlements combined; again the ancient irrigation works (of which the Papago have none) are much more extensive than the modern acequias, dams, and reservoirs of the Mexicans; and finally the trincheras are unique. The great extent of the prehistoric irrigation works is especially impressive; the ancient acequia in Arivaca valley was raised above the flood-plain and 150 feet in width, the confining banks being occupied by nearly continuous rows of habitations, while the modern acequia, put in through American enterprise, is a simple ditch 8 to 10 feet wide; and a single one of the many prehistoric villages in the valley comprised 130 habitations, or fully twice as many as those of the modern American, Mexican, and Indian inhabitants. It may be noted also that a village in this valley and one or two others elsewhere have remains of what appear to be corrals containing tanques for water, indicating the domestication of a rather small animal (perhaps the vicuña). Viewed collectively, the prehistoric remains indicate an ancient population much more extensive than that of the present; for the great number of the villages may not be ascribed to successive occupation, since the irrigation ditches are so large and carried so far up the valley sides as to be

adequate for the supply of a large contemporaneous population and at the same time to be inconceivably extravagant if only a small population were to be supplied at a given time. It is of course possible that the prehistoric precipitation was greater than that of the historical period, but there is no special warrant for this supposition, which is moreover inherently improbable and also unnecessary. It may be observed summarily that the archeologic and ethnologic data in the region indicate a numerous and peaceful agricultural population at a period probably between two and five centuries before the Spanish invasion, and suggest (1) that this population began to suffer from forays by a predatory enemy dwelling in the high Sierra, (2) that the system of forays gradually grew into warfare for vengeance and reprisal, (3) that the peaceful folk found a temporary refuge in the trincheras, and (4) that the irrigation works were finally destroyed, whereby the valley tribe was all but annihilated and driven partly into the remoter desert fastnesses, partly into the more northerly valleys tributary to the Colorado—the desert remnant being the immediate ancestors of the Papago. It is not necessary to dwell on the details of this succession or even to affirm its verity beyond the trustworthiness of a good working hypothesis; the essential point, which seems to be indisputable, is that the district supported a numerous agricultural or largely agricultural population, who were able to maintain themselves, despite the prevailing aridity, by means of an elaborate system of irrigation. This population and culture seem to have been essentially indigenous, and, up to the time of decadence, not greatly influenced by external conditions. Accordingly, during the prehistoric period represented by the ruins, the indigenes of Papagueria made conquest, not only of the soil as do the modern Papago, but of the waters; and thereby their culture rose to a higher plane, yet a plane which may justly be regarded as normal to the desert.

The lesson of human life in the desert is found in the coöperation between men, animals, and plants in such wise that the sum of vitality is multiplied and at the same time subordinated to intelligence: Man consumes fruits and seeds, yet distributes the germs of plants useful to him; as he advances in culture he conserves the germs unto the season of germination; he either neglects or directly destroys useless and noxious plants; and in

all these ways he improves the flora. Man subsists in part on game, yet, under the economy of solidarity, he does not exterminate the game animals and thereby cut off a supply at its source, but rather coöperates with them in a communality analogous to that between the animals and plants; he aids, albeit unconsciously, the herbivores in escaping the carnivores, and for this service they pay tithes in flesh; he even enters into coöperation with carnivores, such as the coyote, which he spares to become his scavengers, and they reciprocate by forming a semiconscious cordon of protectors about the camp or village; and in these and other ways a partial cultivation of plants and domestication of animals is brought about collectively, and man enters into and dominates the solidarity of desert life. Then if peace persists he begins to transport and preserve water, and this is the germ of irrigation by which the wilderness is made to blossom and by which both plants and animals are multiplied and artificialized.

INTERRELATIONS OF LIFE

When the plants, animals, and men of the desert are compared with respect to physiologic or ontogenic characters, it is found that the stationary plants have suffered greatest modification, the environment-driven animals less, and the environment-molding humans least of all; but when they are compared with respect to collective or demotic modification, it becomes manifest that the moveless plants are least, the moving animals more, and prevising men most profoundly modified.

When the life of the desert is compared with the vital phenomena of humid regions, it is found that under the pressure against an adverse inorganic environment, the beginning of the control of environment springs lower on the stem of phylogenic development—that the desert species, genera, and orders enter into a mutually beneficial coöperation while yet the rainfed organisms are frittering energy in internecine strife. Thus it would appear that among plants and animals, as among men, hard necessity is the mother of progress. It would also appear that among plants and animals, as among men, strength lies in union; and progress in combination leads to solidarity.

The great lesson of plants, animals, and men in the desert is found in the modification of organisms and the development of

organizations: Under the hard environment, organisms cease to strive against one another and each strives against inorganic nature; under the common pressure they are forced into union, and thus coöperation is initiated. Now there are three stages in coöperation; the first stage is that in which the organisms merely stand together for mutual protection, but retain undiminished individuality—this is communality; the second stage is that in which individualities blend through miscegenation between unlike organisms, as between the yucca and yucca moth—this is commensality; the third stage is that of voluntary inclusion and exclusion of organisms for the common welfare of the solidarity or for the especial weal of the dominant organism, whether ant or man—this is the stage unwittingly, yet not unhappily, called agriculture.

The lesson of life in Papagueria may easily, and within limits safely, be extended to other regions; for the phenomena and relations are more or less closely paralleled elsewhere. It may appear paradoxical to affirm that it is in arid districts, where agriculture is most arduous, that agriculture began; yet the affirmation is not gainsaid but rather supported by history, and is established beyond reasonable doubt by the evidence of the desert organisms and organizations.

So, whatever its last estate, in its beginning agriculture is the art of the desert.

THE ALGONQUIAN APPELLATIVES OF THE SIOUAN TRIBES OF VIRGINIA*

BY WILLIAM WALLACE TOOKER

The issue, almost simultaneously, of two valuable bulletins from the Bureau of American Ethnology—"The Siouan Tribes of the East," by James Mooney, and "The Archeology of the James and Potomac Valleys," by Gerard Fowke—brings to my desk such a collation of facts, historical, geographical, and archeological, that it enables me to supplement their efforts from another field of research, and at the same time to contribute additional memoranda to the nomenclature of our native races, by presenting analyses of the Algonquian appellatives of these people, whose tribal synonymy, confederacy, and migrations have been carefully discussed by the first, and the archeology of whose territory, from personal researches and excavations, has been the theme of the second.

When Captain John Smith and his companions first discovered the falls of the James river, in May, 1607, the native guides who accompanied the explorers related remarkable stories of a nation living farther up the stream toward the mountains, called the *Monacans*, who, at the time of the falling of the leaf, came down and invaded their country. The fear of these western Indians was such that no inducements the discoverers made could persuade these Powhatans to guide them to the habitations of these people. The stories, however, made so deep an impression upon the minds of the adventurers that in the following spring Captain Smith was assigned to the command of sixty men, in order to discover and to search for the commodities of the *Monacans*, so as to load a ship for home. But so unseasonable was the time and so opposed was the captain of the vessel to load with anything but the "phantastical gold," as it is expressed, which he, as well as others, believed was obtainable among the *Monacans*, that it caused much ill-feeling to

* Read before Section H, American Association for the Advancement of Science, at Springfield, Mass., September 3, 1895.

arise among the colonists; for Captain Smith, having been of a more practical and conservative nature than many of his associates, preferred to load the ship with cedar, which he justly claimed was a more "present dispatch than either durt or the reports of an uncertain discovery." After considerable delay the ship was finally loaded with cedar, and the attempt to discover the country of the *Monacans* was postponed.* In the fall another effort was made, when Captain Newport, with one hundred and twenty men, went forth for the invasion of the unknown country. Arriving at the falls, they marched by land some forty miles in two days and a half, and then returned by the same path. They discovered two towns of the *Monacans*, called *Massinacack* and *Mowhemenchouch*. On their return they were delayed by searching in many places for supposed mines, which was really the object of the expedition, having with them a refiner, who persuaded them to believe that he extracted a small amount of silver from the rock, and, as they relate, better stuff might be had for the digging.†

Smith condenses the information which he subsequently gleaned from the natives as follows: "Vpon the head of the Powhatans [James river] are the *Monacans*, whose chiefe habitation is at *Rasauweak;* vnto whom the *Mowhemenchughes*, the *Massinnacacks*, the *Monahassanughs*, the *Monasickapanoughs*, and other nations pay tributes. Vpon the head of the river of *Toppahanock* [Rappahannock] is a people called *Mannahoacks*. To these are contributers the *Tauxanias*, the *Shackaconias*, the *Ontponeas*, the *Tegninateos*, the *Whonkenteaes*, the *Stegarakes*, the *Hassinnungaes*, and divers others, all confederates with the *Monacans*, though many different in language, and be very barbarous, liuing for the most part of wild beasts and fruits." ‡

One of the *Mannahoacks*, belonging to the tribe called the *Hassinnungaes*, whom Smith captured upon the upper waters of the river Rappahannock, when interpreted, said that the *Monacans* were their neighbors and friends, and did dwell, as they, in the hilly countries, by small rivers, living upon roots and fruits, but chiefly by hunting.

This brief summary embraces nearly all the knowledge that we possess relating to these tribes during the period of settlement. After 1609—although undoubtedly often in contact with

* Arber's Smith, p. 106. † Ibid., p. 438. ‡ Ibid, pp. 366, 367.

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the settlers through trade and otherwise—nothing whatever was recorded or preserved relating to them for over sixty years. Even the significations of these tribal appellatives, correct interpretations of which are absolutely necessary for an exhaustive and conclusive study of these people, have been forgotten for many generations.

The questions that now arise, and which I shall endeavor to answer, are these: First, What were the commodities of the *Monacans* that Smith was instructed to search for? Second, What was it that gave rise to lasting impressions in the minds of the Virginia colonists that valuable mines of copper, iron, gold, and silver were to be found in the same region? Third, Can any of the *Mannahoacks* be identified with tribes or peoples of a later historic period? Fourth, To what language must we assign these and other names of Captain John Smith?

Mr James Mooney, in his "Siouan Tribes of the East," has ably demonstrated by his synopsis of early historical references, by his identification of the geographical locations of the tribes in after years, and by his conclusions derived therefrom, that the *Monacans* were not the ancestors of the *Tuscaroras*, as has been accepted ever since the time of Jefferson, the sponsor for this baptism, but were the progenitors of those people, who were subsequently, by a fortunate series of circumstances, identified by Horatio Hale as speaking a primitive dialect of the Siouan tongue, thus indicating that the original home of the Siouan family must have been in the east. Therefore it is unnecessary at this time and place to elaborate further on these points that Mr Hale has so learnedly presented from linguistic sources and which Mr Mooney has augmented and confirmed from historical channels, but to accept it as an incontrovertible conclusion that the *Monacans* and their tribal confederacy as such, including the *Mannahoacks*, must be assigned to the Siouan linguistic stock.

These truths accepted, I will proceed to analyze those terms, descriptive in their character, which we have found applied to these people in the early days of the period of colonization. These appellatives were bestowed upon them by their neighbors on the east, the Powhatans and their confederates, who are well known to have been a branch of the Algonquian linguistic stock. Therefore there ought to arise no question whatever in the mind of the critical student of Smith's works against the dictum now

submitted, that every one of these terms, without a single exception, are necessarily Algonquian, and consequently should be analyzed and translated by the aid of that language, no matter what the nativity of the people themselves may have been. This declaration will also apply to every aboriginal name occurring upon Smith's map of Virginia, for he was never in contact with other than an Algonquian long enough to learn a name. Besides, the historical evidence would seem to indicate that the greater number of these terms were heard spoken from the lips of the Powhatans long before the colonists saw a *Monacan*. For instance, Captain Newport's guide and interpreter was a savage of Powhatans called *Namontack*.* Newport named a mine six miles above the falls after him because he discovered it.† Smith's interpreter while among the *Mannahoacks* was an Algonkin, as was also his *Tockwogh* interpreter while interviewing the *Sasquesahanoughs*. His very brief parley with the *Massawomecks*, as he relates, was entirely by signs.‡ Therefore it seems to me that failure would be necessarily foreordained in seeking for other than Algonquian elements in any of the aboriginal names of Virginia as bequeathed to us by Captain John Smith.

William Strachey, secretary of the colony, 1609 to 1612, who was more or less familiar with the language of the Powhatans and has left us a valuable vocabulary of that dialect, derives the name *Monacan* from *Monohacan* (or *Monowhauk*), "a sword,"§ while Heckewelder, through the Delaware, translates it as "a spade or any implement for digging the soil," corrupted from *Monahacan*.‖ Heckewelder is so rarely correct in his place-name etymologies that he should have due credit for this suggestion, for the fact appears that both of these authorities are correct in their identification of the verbal element of the name, but not in the grammar, application, or true analysis of the term as applied to a people.

The prefix *Mona* is undoubtedly the verb signifying "to dig," occurring in the same primitive form in many Algonquian dialects, from the Cree *Móona*, in the far north, to the Narragansett *Mona*, on the east, and is reproduced at the south in the Powhatan *Monohacan*, "sword," literally a digging instrument, from

* Arber's Smith, p. 438.
† Strachey, p. 31.
‡ Arber's Smith, p. 422.
§ Mooney, p. 26.
‖ Heckewelder's Names, ed. by Reichel, p. 280.

Mono, "to dig," prefixed to *-hacan*, an instrumentive noun suffix used only as a terminal in compound words denotive of things artificial,* so designated because so used by the Indians when purchased from the settlers. The same verb figures in other Powhatan cluster words, thus revealing its identity; for instance, in *Monascunnemū*, "to cleanse the ground to fit it for seed," making it the equivalent of the Narragansett *Monaskúnnemun;* Delaware *Munáskamen*, "to weede." It will be found by analyzing carefully the various synonyms of the term *Monacans*, or *Monanacans*,† with its English plural as displayed, that it resolves itself into the components of *Monâ-ack'añough*, from *Mona*, "to dig;" *ack*, "land or earth," with its generic plural of *-añough*, "nation or people"—that is, "people who dig the earth"—the phonetic sounds of which were shortened into *Monacans* by the English, which may be freely and correctly translated as the "diggers or miners." The term as such probably designated the whole confederacy collectively. This abbreviation of the sounds of tribal appellatives is characteristic of English notation, as in *Mohawks*, from *Mauqua'uog; Mohegans*, from *Manhigan-euck; Pequots*, from *Pequtto'og*, and others.

The "chiefe habitation" of the *Monacans*, according to both Smith and Strachey, was at *Rasauweak, or Rassawek*—a statement that is fully confirmed by analysis of the name. Its earliest notation, however, appears in the Relation of Captain Gabriel Archer,‡ which Professor Arber suggests may be the official report presented by Captain Newport on his first return, in July, 1607, therefore possibly antedating Smith, in the very corrupt form of *Monanacah Rahowacah*, which, to follow Smith, should have been more correctly printed as *Monacanough Rassauwek*, thus indicating that there was originally a grammatical continuity between the words as uttered by the savages of the lower James. Frequently the sounds represented by *w* in some of the northern Algonquian dialects is replaced by *r* in the Powhatan and other cognate dialects. Allowing for these alternating sounds, or what Dr Boas terms alternating apperceptions of one and the same sound,§ the derivation of *Rassauwek* is probably from *wassau*, "it is bright, it glistens or shines," which, with a suffix applicable to the object described,‖ was a term much em-

* Howse Grammar of the Cree, p. 182.
† Smith, p. 2.
‡ Arber's Smith, p. xlvi.
§ American Anthropologist, vol. 2, p. 52.
‖ Tooker; American Antiquarian, vol. 17, p. 8.

ployed by many Algonquian tribes to designate any kind of white metal or mineral, but which in this case, I believe, for many reasons, was a synonym for mica*—an article of trade and highly valued by the tribes of the west and east, as indicated by its discovery in the mounds of Ohio, in the graves of Virginia, and elsewhere. The terminal affix *-wek* or *-weak* (= Massachusetts *wek* or *week*), "house or home," is the conditional third person singular of the verb—"when (or where) he is at home." Thus we have, in accordance with this analysis, *Monâ-ack'añough-wassau-wek*, "the home of the mica diggers," or "home of the people who dig the earth for something bright." Gerard Fowke† informs us: "Several mica mines have been opened within a mile of the court-house [Amelia county]. The miners report that in digging they sometimes discover small piles of mica which have been detached from the rock and heaped together. These pieces, usually of poor quality, as if rejected by the workers, are doubtless from aboriginal excavations, as they lie beneath several feet of accumulated earth, and there is no tradition of early mica mining in this section by the whites."

Although this discovery is not exactly in the direction of *Rassauwek*, as indicated by Smith on his map, it is in the territory of the *Monacans*, and fully confirms the foregoing interpretation, in the fact that mica mining was one of the industries carried on by the early occupants of this valley. The exact site of *Rassauwek* has not been as yet fully established. Smith locates it between the two branches of the river; but Mr Fowke, who has devoted considerable personal attention to the question, says the point of land between the two rivers is irregular, infertile, rather difficult of access, and nothing is found to show that it was ever occupied by the Indians. On the other hand, Elk island, in Goochland county, just below Columbia, bears every indication of Indian occupancy, and many specimens of steatite pottery, some rough, others tolerably well finished, have been found on the island, whereas such are extremely rare elsewhere in the vicinity. From which he concludes: "Altogether it is very probable that the main town of the *Monacans* was on Elk island." But he describes another Indian settlement, farther

* Compare Wósogolûmin', mica, Micmac (Rand), and Wóseântčchk, glass.

† "Archeologic Investigations," p. 10.

up upon the left bank of the Rivanna, between that river and the James, which corresponds more to Smith's location. While suggesting this may have been the site of *Rassawek*, he thinks the evidence favors Elk island. Smith's location of tribes out of the horizon of his own researches and explorations must be regarded as approximate only, although the relations of the Indians, which were his sources of information as regards unknown countries, were in the main quite accurate, as later discoveries bore witness. From Mr Fowke's description of the island, it may have been at one time the abiding place of another wing of the confederacy, which the occurrence of steatite vessels would seem to indicate.

This wing of the *Monacans*, the *Monahassanughes*, were noted down by Smith both on his map and in his works. Strachey* places them at the foot of the mountains. It will be observed that we have here precisely the same verbal prefix as in the former term, and it should unquestionably sustain the same derivation of *Mona*, "to dig." Now as to the second component, *-hassan*. In the Massachusetts and in some other dialects *hássun*, *hássin*, or *ássin*, with or without the English aspirate, signifies "a rock," which, together with its generic plural of *-añough*, "people," gives us *Monâ-hassun'añough*, "people who dig the rock"—that is to say, they were "miners or quarrymen," which fully describes in a most remarkable way those people who excavated in the steatite or soapstone quarries. Many of these quarries, situated in the valleys and among the hills and forests once occupied by these primitive miners, have been investigated by Mr F. H. Cushing, Mr Gerard Fowke, and others. The accumulated debris of the diggings, the abandoned pot-forms, the fragments of steatite vessels, and the rude digging implements of stone bear witness of aboriginal labor through a long series of years under like conditions. The quarries, especially of Amelia county, studied by Mr Cushing, were of considerable extent, and must have been worked long anterior to the period of colonization—a period from which we must necessarily date its decline.

In *Nahyssan*, of John Lederer, and *Hanohaskie*, of Batt, we find synonyms of *Monâ-hassan'añough*, as suggested by Mr Mooney; for the guides and interpreters of both of these travelers were

* History of Travaille, p. 48.

Algonquians or spoke the language, and these were forms undoubtedly current among the settlers and traders in their time.

Farther to the northwest, as laid down on Smith's map and referred to but once in his history, appears another tribe of the *Monacans*, under the appellative of the *Monasukapanoughs* or *Monasickapanoughs*. As is evident to all, we have here displayed another name with the same verbal prefix, as in the other cases, signifying to dig. Surely this confederacy well deserved the title bestowed upon them collectively of being the "diggers." Analysis of this word, as in the previous terms presented, gives us *Mona-sukapan'añough*, "people who dig the *sukapan* or *sickapan*." What is the "*sukapan*"? is the problem that now confronts us. This is comparatively easy of solution, although seemingly difficult at the first glance. The native of *Hassunungae*, when interpreted, stated, among other matters, that the *Monacans* did dwell as they and lived upon roots. The generic name for roots, tubers, or bulbs was *pen*, varying in some dialets to *pun*, *pan*, *pin*, *pon*, or *bun*. Therefore the "*sukapans*" were the tubers of a plant which these barbarous people dug for food and was perhaps their staple product. We, no doubt, find the parallel of "*Sukapan*" in *Sagapon* (or *Sackapun*), a component of a place name on Long Island, New York, in the term *Sagapon'ack*, now applied to a post-office and hamlet in the town of Southampton, from the first syllable of which the village of *Sag Harbor* derives its name. The Micmac (Rand) *Segubun*, "a ground-nut," is another parallel. One of the towns of the *Kuskarawaokes* (later known as the *Nanticokes*), on the eastern shore of the Chesapeake, had the same name. Smith says:* "Here doth inhabite the people of *Sarapinagh* (= ground-nut people), *Nause*, *Arseek*, and *Nantaquack*, the best Marchants of all other Salvages." On Long Island the name was applied to the common ground-nut (*Apios tuberosa*, a leguminous, twining plant, producing clusters of dark purple flowers and having a root tuberous and pleasant to the taste), which are still to be found in great abundance at a swamp in the vicinity known as "*Sagg* swamp." The prefix which denotes the species cannot in all cases be identified, but the generic name with its localizing affix is easily recognizable. Not long since, while in conversation with an intelligent Chippeway Indian in regard to this particular prefix, he informed me

* Arber's Smith, p. 415.

that it denoted a species which were "hard or difficult to get out of the ground." While the Massachusetts *siogkke*, "hard or difficult," may resemble the Long Island *sagga* (or *sacka*) in sound, I am inclined to believe he was mistaken, and that the Long Island *sagga* and the Powhatan *suka* (or *sicka*) are identical, and are the parallel of the Cree *súgge*, "thick, close together"*—a derivation that fully describes the tubers of the *Apios tuberosa*, which grow close together, strung in clusters on a fibrous root. It was probably the same plant discovered by Captain Gosnold on one of the Elizabeth isles, on his visit to the New England coast in 1602, which John Brierton, one of the voyagers, describes as "ground nuts as big as egges, as good as Potatoes, and 40 on a string, not two ynches vnder ground."† Dr J. W. Harshberger, of the University of Pennsylvania, informs me that "*Apios tuberosa*, or, as it is now called, *Apios apios*, by the recent upheaval in systematic names, is a plant of wide distribution and occurs abundantly in Virginia. I have two recorded localities for it—Jamestown and southwestern Virginia—and it is therefore to be found on the upper James." It was undoubtedly the same plant seen by Hariot on the Roanoke,‡ viz: "*Openauk* are a kind of roots of round forme, some of the bignes of walnuts, some far greater, which are found in moist and marish grounds, growing many together, one by another, in ropes, or as thogh they were fastened with a string. Being boiled or sodden, they are a very good meate." Asa Gray, the eminent botanist, said: "Had civilization started in America instead of Asia, our ground-nut would have been the first developed esculent tuber, and would have probably held its place in the first rank along with potatoes and sweet potatoes of later acquisition. Thus the *Monâ-sukapan'añough* were "a people who dig ground-nuts." Compare Otchipwe (Baraga) *Nin Monâ apini*, "I dig potatoes." In the historic name of *Saponi*, as applied to a tribe in the annals of Virginia and North Carolina, and as evident by its generic *pon*, we have all that remains of the original appellative, and I believe Mr Mooney (p. 27) is correct in suggesting its derivation therefrom.

The two tribes visited by Captain Newport, and mentioned by Smith as the *Mowhemenchughes* (or *Mouhemenchouch*) and the *Massinacaks*, do not seem to come under the same head as the

* Howse Grammar of the Cree, p. 40. † Arber's Smith p. 334. ‡ Narrative, p. 26.

others in being "diggers," although they were confederate or tributary with them. The description of some as being very barbarous, living for the most part on wild beasts and fruits, shows that they were not to any extent agriculturists and furnishes us a clue to the meaning of the term, when divided into its components of *Mowhe-mench'ughes*. The verbal prefix *Mowhe* (or *Mouhe*) in its sounds is identical with the Delaware *mawé*, Narragansett *Mowi* (or *Moúwi*), "to gather," "to bring together," "to pick up," etc. *Mench* is evidently the generic for small fruits or grain, in the plural form, the parallel of the Narragansett *meneash*, Micmac *Menich*, Delaware *Minak*, "fruit or berry," which gives us with its animate plural affix *-uk* (or *-ugh*), *Mowhe-mench'ugh*, "those who gather fruit"—that is to say, they were a hunting people, who lived to a great extent on fruit or wild berries. There is a possibility and I would suggest that in the *Mahoc*, who occupied the territory between the falls of the river and the mountains at the time of Lederer's visit in 1670, were the survivors of the *Mowhe-meuch'ughes* of Smith, and that in the term "*Mahoc*" we find a survival of the Algonquian term for the fruit-pickers.

Massinacack is marked as a king's residence on Smith's map. Strachey says:* "The neerest called *Mowhemincke*, the farthest *Massinnacock*, distant one from another fourteen miles." Its other synonyms are *Massinnacacks*† and *Massinacak*.‡ This term differs from the others in being simply a place-name, showing no action as performed by a verb as displayed in the previous interpretations and as evidenced by its locative termination. As to its analysis, I would suggest that *m'* is the impersonal particle, *assin*, "stones," which, with its substantival *ac* and locative suffix *ak* (= Narragansett *auk-it*, Massachusetts *ohkit*, Delaware *hacking*), gives us *M'assin-ac-ak*, "at the place of stones." It is quite possible that it may refer to the "pyramid of stones" which John Lederer observed in 1670 near the village of Monacan, ten days' travel above the falls. He was told that it represented the number of a colony which left a neighboring country because of overpopulation, a condition easily reached among hunting tribes. The emigrants, having been chosen by lot, had come to the present location under the leadership of a chief called *Monack*, from whom they derived the name of *Monacan*. Mr Mooney comments on

* Hist. of Gravaille, p. 131. † Smith, p. 71. ‡ Ibid., p. 438.

this statement:* "As the explorer stopped with them only long enough to learn the road to the next tribe, his version of their migration legend must be taken with due allowance." This pyramid of stones was probably erected for reasons similar to that mentioned in the patent for Livingston Manor, New York, dated November 4, 1684:† "Place called by the natives *Wawanaquassick* (or, better [pp. 696, 697], *Mawanaquassick* = place where stones are gathered together), where the heaps of stones lye . . . the said heaps of stones upon which the Indians throw on another as they passe by from an ancient custom among them."

The *Mannahock* or *Mannahoack* confederacy consisted of perhaps a dozen tribes, of which the names of the principal eight have been preserved, although only four of them are shown on Smith's map. Smith's own acquaintance with them seems to have been limited to an encounter with a large hunting party in 1608. Smith, however, was a man who knew how to improve an opportunity; and having the good fortune to take one of the *Hassinnungaes* prisoner, he managed to get from him, by the aid of his guide and interpreter *Mosco*, a very fair idea of the tribes and territories of the confederacy, their alliances and warfare, their manner of living, and their cosmogony, and succeeded before his departure in arranging a precarious peace between them and their hereditary enemies, the Powhatan confederacy.

Smith's intepreter on this occasion was a savage of *Wighcocomoco*, at the mouth of the Potomac river, and the names of these *Mannahock* tribes are of his rendering, and, as the fact appears, are Algonquian interpretations of Siouan names. *Mannahock*, however, is an exception, and is evidently his descriptive term for the whole of these people collectively and did not indicate a separate tribe. I would suggest its analysis from the indefinite particle *m'* prefixed to the verbal radical *an*, "to be more than," "to surpass," united to the verb *hahânu* or *ahânu*, "he laughs;" *ahânuock*, "they are merry;" or, as the term would be rendered in the Massachusetts or Narragansett, *M'anahânuock*, "they are very merry, or a very merry people." The verbal root is probably imitative. Smith remarks, in striking confirmation of this derivation:‡ "And so we left foure or five hundred of our merry *Mannahocks* singing, dancing, and making

* Siouan Tribes, p. 29. † Doc't Hist. N. Y., vol. 3, p. 624. ‡ Arber's Smith, p. [illegible]

merry." Dr Hale remarks of Nikonha, from whom he discovered the Siouan affinity of the Tutelos:* "A wrinkled, smiling countenance. Not only in physiognomy, but also in demeanor and character, he differed strikingly from the grave and composed Iroquois among whom he dwelt. The lively, mirthful disposition of his race survived in full force in its latest member. His replies to our inquiries were intermingled with many jocose remarks and much good-humored laughter." In a verity, his portrait shows all these characteristics of his race, which, together with the translation of their Algonquian appellative, is collateral evidence as to the Siouan affinity of some of these tribes.

There is but little known as to the tribes of this confederacy. The pressure of the cruel Iroquois on the north and the advancement of civilization on the east probably compelled them to migrate early to the southward; therefore I shall devote but a few words to the less interesting. The savage whom Smith captured said that† "he and all with him were of *Hassininga*, where there are three kings more, like vnto them, namely, the king of *Stegora*, the king of *Tauxuntania*, and the king of *Shakahonia*, that were come to *Mohaskahod*, which is onely a hunting town." These are the four tribes marked on Smith's map; consequently must have been considered the most important.

The *Hassinnungaes* or *Hassinuga* is derived from *hassun*, "a rock;" *wónogk*, "hole or den," which, with the terminal of the animate plural, denotes "those who dwelt in caves or holes of the rocks," thus indicating a low state of barbarism, as Smith truthfully observes. Its equivalent is found in the Massachusetts *Hassunnegk*, "cave" (Eliot), Gen. 29: 7, 17; *Hassunonogqut*, "holes of the rocks," Jer. 16: 16. A number of these caves, once inhabited by red-men, have been discovered in Virginia. William H. Holmes‡ describes one of these typical rock-shelters, situated in Harrison county, due west from the home of this tribe. (Strachey, however, states that they lived farther west than Smith locates them.) This shelter displayed on its rear wall some interesting petroglyphs, and in the debris of its floor were found potsherds, arrow points, paint-stones, and other objects, both natural and artificial. Professor H. C. Mercer, of the University of Pennsylvania, has explored many of these rock-

* Tutelo Tribe and Language, p. 9.
† Arber's Smith, p. 427.
‡ American Anthropologist, vol. 3, p. 217.

shelters of Virginia, which showed no great antiquity—in fact, he was astonished by the comparatively modern evidence of their occupancy by the red-men.

The *Stegarakies* or *Stegoras* (= *stegan-ac'anoughs*) survived as the *Stenkenocks*, as mentioned by Governor Spotswood, in 1711, as one of the tribes living near Fort Christanna, in Virginia, which the colonial government desired to secure from the further attacks of the Iroquois.* This name is undoubtedly Algonquian, as its terminal indicates, but so far I have been unable to identify its prefix.

The *Tauxanies*, *Tanxsintania*, or *Tauxuntania* were probably those mentioned by Lederer as the *Nuntaneuck*, speaking the same language as the *Monacan*, *Nahyssan*, *Saponi*, and others. This term in one form, *Tauxanies* (= *Taux-anoughs*), seems to denote a "people of a short stature;" Powhatan *Taux* or *Tanks*, "small, little;" Delaware *Tangitto*, "short, small," while its longer forms seem to contain the radical *-itan*, "a flowing stream or river;" hence *Taux-itan'anoughs*, "people of the little rivers," as referred to by Smith.

The *Shakahonia* or *Shackaconias* were "the stone people;" *Shacahocan-añoughs*, Powhatan, [Strachey] *Shacahocan*, [Smith] *Shacquohocan*, "stone." This meaning as rendered by these two authorities is not the literal one, for its instrumentive generic suffix *-hocan* indicates something artificial.† It denoted possibly a stone prepared for slinging, tossing, or rolling, according to the meaning of its prefix *shacka* or *shacquo-*, which I have not been able to identify to my satisfaction. In the name *Shoccories* of Lederer and Lawson we find probably its synonym of a later period. They were living in close proximity to the *Occaneeches* and *Enos*. Possibly the latter were but another village of the *Shoccories* when visited by Lederer, as they were only fourteen miles apart, with the same customs. They were devoted to an athletic game, described by Lederer in 1672 as "slinging of stones;" and in 1701, when seen by Lawson, the two tribes were united, and had not forgotten their old game mentioned by Lederer, which may be recognized as the universal wheel-and-stick game of the eastern and southern tribes; for Lawson says in his narrative they were much addicted to a sport they call chenco, which is carried on with a staff and bowl made of stone, which

* Mooney, p. 21. † Howse's Grammar of the Cree, p. 182.

they trundle upon a smooth place, like a bowling green, made for the purpose.*

The *Ontponeas* (= *Ont pon'anoughs*) were another "people of roots or tubers," as shown by its generic *pon*. The species indicated by its prefix *ont* I have been unable to identify. It was probably but another descriptive term for the *sagapon*, for Strachey gives us *Ouh-punnawk*, "a ground-nut." The *Mei'pontskey* of Governor Spotswood, who in 1722 were living, under the protection of the English, near Fort Christanna, were probably a remnant of these people.†

The *Tegninateos* or *Tegoneas*, as Smith varies their name, are but briefly mentioned. They were probably a people dwelling at that time far off in the mountains or, as Smith remarks, "in the hilly countries." The name evidently contains the Algonquian element *-atin*, "hill or mountain," and the terminal of *-añough* or *-añies*, "people." The prefix *Tegni* or *Tego* is seemingly from the same verbal root as the Narragansett *tagu*, "to go up," and possibly related to the Massachusetts *tohkoo*, "to climb;" hence *Tego-atin'añoughs*, people who climb the mountains, or "the mountaineers," as we might put it. It is quite possible that the *Toteras* or *Toleras*, who are represented in Batt's manuscripts ‡ as a "mountain tribe," were the descendants of this nation.

The *Whonkentyaes* or *Whonkenteas* are another tribe of the *Mannahocks*, or tributary to them, who are unplaced on Smith's map. The phonetic sounds of this appellative suggests that they were probably the ancestors of the *Akenatzies*, or *Occaneeches*, as it is varied, who were living, as Mr Mooney has indicated, on an island just below the confluence of the rivers Dan and Staunton, in Mecklenburg county, Virginia, when visited by John Lederer in 1670. I would suggest that the derivation of the term *Whonkenté-as* or *Whon-kenchi-aneas* as from the Narragansett *awâun*, Massachusetts *auwon*, "there is somebody," *i. e.*, who is strange or different from those speaking.§ The second component, *-kentie*, *-kenatzie*, or *-caneeche*, seems to have its parallel in various forms of the verb "to talk" or "to speak," as in the Long Island *unkenchie*, "the strange talker;" Narragansett *awâun-ken'taunchem?* "Who are you that discourses?" Delaware *n'iechsin*, "to speak;" Powhatan *kekaten*, "you tell," which, with its terminal, gives us

* Mooney, p. 63.
† Ibid., p. 37.
‡ Col. Hist. N. Y., vol. 3, p. 194.
§ See Trumbull's Algonkin Names for Man, p. 14.

whon-kentie-añies, "people of a strange talk, or another speech." This analysis confirms Smith's statement that the *Mannahocks* were "many different in language." Again, in noticeable corroboration of this derivation, the *Occaneeches* seem to have been of a different linguistic stock to their Siouan neighbors. Mr Horatio Hale, quoting the Virginia historian, Beverley, says:* "The general language here used is that of the *Occaneeches*, though they have been but a small nation ever since those parts were known to the English; but in what their language may differ from that of the Algonkins I am not able to determine. Further on he [Beverley] gives us the still more surprising information that this general language was used by the priests and conjurers of the different Virginia nations in performing their religious ceremonies in the same manner [he observes] as the Catholics of all nations do their mass in Latin." Now, it appears to me, on careful consideration of this statement of Beverley's in all its aspects, that it is open to only one construction—that is to say, if the term *Whonkenties* is a translation by an Algonquian interpreter of a Siouan description of a nation of another or different speech, residing among and tributary to them, and is also, as I suggest, a synonym for *Occaneeche* or *Akenatzie*, it would surely lead us to infer that the language of the *Occaneeches* was not Siouan, but was really nothing more nor less than a dialect of the Algonquian. It is evident that traders living in the English settlements, closely associated with the Powhatan Indians and employing them as guides, would not be likely to speak other than their language in bartering with the outlying tribes.

So far as the religion of the Virginia Indians is concerned, Mr Mooney observes:† "Lederer's account of their religion is too general to be definite, and he neglects to state to what particular tribal language the Indian names belong." In answer to this observation, I would remark, all that is necessary in order to identify the language to which these names belong is to compare Lederer's narration with that of Captain John Smith. Lederer says:‡ "They worship one God, creator of all things, whom they call *Okaeè*, others *Mannith* (= Narragansett *Manit*); to him alone the high priest, or *Periku*, offers sacrifice, and yet they believe he has no regard for sublunary affairs, but commits the

* Tutelo Tribe and Language, p. 12.
† Siouan Tribes of the East, p. 33.
‡ Discoveries, p. 11.

government of mankinde to lesser deities, as *Quiacosough* and *Tagkanysough*—that is, good and evil spirits. To these, inferior priests pay their devotion and sacrifice, at which they make recitals to a lamentable tune of the great things done by their ancestors."

On the other hand, Smith says:* "This sacrifice they held to be so necessary that if they should omit it their *Okee*, or devel, and all their other *Quiyoughcosughes*, which are their other gods," etc. The term *Okee* of these two early authorities is undoubtedly related to the Massachusetts *Ohke*, "earth," the passive inanimate producer; *Ok-as*, the passive animate producer or agent of production.† Spelman‡ calls this god *Cakeres*, seemingly a variation; related also to the Delaware "*Kickeron*, who is the original of all, who has not only once produced or made all things, but produces every day," which Dr Brinton terms the eternally active, hidden part of the universe.§ Hence Smith may have been in error in assigning to the god *Okee* the attributes of his satanic majesty—a god whom Lederer more correctly termed "the creator of all things." In addition, Smith in his brief vocabulary gives us *Okee*, "gods;" *Quiyoughcosughes*, "pettie gods and their affinities." The latter term, as well as Lederer's two, with the terminal in *-osough*, is what Howse‖ terms the form of the adjective animate verb (= Massachusetts *-ussu;* Narragansett *-êsu;* Cree, *-issu*, "he is or it is"). Hence we have *Quiyoughcosugh*, "he is lesser or little," which may be related to the Massachusetts *Ogguhsussu*, "it is lesser or little." To this god the Powhatans offered yearly a sacrifice of children.¶ *Tagkanysough* (= *Tackan-issu*), "he is of the wilderness," "god of the forest." This agreement of Smith and Lederer, together with the analysis of the names, proves beyond question that the general language used by the Virginia tribes in their religion, and in their intercourse with alien tribes, must have been necessarily Algonquian. The fact that Beverley, as he remarks, was unable to determine the difference between the language of the *Occaneeches* and that of the *Algonkins* would indicate to my mind

*Arber's Smith, pp. 78, 374.
†See Trumbull's Notes 49, 50, Narr. Club, ed. R. Williams Key.
‡Arber's Smith, p. cv.
§Lenâpé and their Legends, p. 133.
‖Grammar of the Cree, p. 25.
¶Smith, p. 375.

that they were practically identical, with only an archaic difference—a difference similar to that mentioned by Mr Mooney as existing between the Cherokee language and that used in the sacred formulas of their shamans. Mr Mooney says:* "They are full of archaic and figurative expressions, many of which are unintelligible to the common people and some of which even the shamans themselves are now unable to explain. These archaic forms, like the old words used by our poets, lend a peculiar beauty which can hardly be rendered in a translation. They frequently throw light on the dialectic evolution of the language, as many words found now only in the nearly extinct Lower Cherokee dialect occur in the formulas which in other respects are written in the Middle or Upper dialect." These archaic traits have been observed by Hale,† Cushing,‡ Matthews,§ and by other explorers into the secret rites of tribes of other linguistic stocks; and all things being taken into consideration, this solution of the *Occaneeche* problem is open to fewer objections than to accept the unlikely supposition that the Algonquian tribes of Virginia used the Siouan language in their religious ceremonies.

It is perhaps needless for me to observe, after the foregoing presentation of the points under discussion, that the questions as to what were the commodities of the *Monacans* and what gave rise to thoughts of mines, as well as questions third and fourth, have been fully answered. The fact that a partial knowledge by the colonists of the language of the Powhatans, acquired during the first few months of the settlement, gave them but an insufficient idea as to what the *Monacans* dug from the earth, and as their knowledge increased and they became more familiar with the language, habits, and customs of the natives, they learned that the *Monacans* mined absolutely nothing desirable. As time grew apace, the truth soon dawned upon their minds that the necessaries of life were more preferable than the phantom gold and other will-o'-wisps of an unknown country, and as these prime essentials were procurable from the industrious native agriculturists nearer home, to this food-quest, more than to any other, was the remainder of Smith's stay in the colony devoted.

*Seventh Annual Report of the Bureau of Ethnology, p. 343.
†Iroquois Book of Rites, p. 46.
‡Second Annual Report of the Bureau of Ethnology, p. 12.
§Fifth Annual Report of the Bureau of Ethnology, p. 456.

UPPER ORINOCO VOCABULARIES

BY A. ERNST

I obtained lately a manuscript copy of the vocabularies of some languages spoken on the Upper Orinoco and its affluents which had been collected by Mr F. Montolieu, a Frenchman, who for several years acted first as secretary to the governor of the Venezuelan territory Amazonas and was finally governor himself (1870 to 1876). The manuscript contains a vocabulary of each of the following languages: Baniva, Barré, Yavitero, Puinabo, Tupi, and Piaroa. Montolieu began publishing them in a Caracas newspaper, *El Tiempo* (July, 1877), and this part was afterwards inserted in the eighth volume of the *Bibliothèque linguistique américaine* (Paris, 1882), pages 274 to 280; but this comprises only the Baniva, Barré, and the first half of the Yavitero (as far as letter H). The rest was never printed, and I have thought, therefore, it would be of some interest to publish the remainder of the Yavitero, together with the Puinabo and Piaroa, languages which still today are very imperfectly known.

The pronunciation is Spanish; *eu* is to sound as in French, when written without a diæresis.

I. Yavitero.

Lagartijo (lizard), *cuito.*
Laolao (a species of fish, of the genus Silurus), *mucurí.*
Lapa (Cœlogenys paca), *iafa.*
Laurel (laurel), *caguizí.*
Lavando (washing), *fiji-faja.*
Lejos (far), *te ie.*
León (puma, Felis concolor), *eguüne, eguane.*
Llévale (take him, conduct him), *fita guata-ié.*
Loro (parrot), *curicuri.*
Luz (light), *camonajadi.*
Madera (wood), *cagueraná.*
Malo (bad), *curiciji.*
Mama (he sucks), *yua.*
Mañana (tomorrow), *iosinasita.*

XUM

Mandioca (cassava plant, Manihot utilissima), *machoca.*
Mapanare (a snake of the genus Lachesis), *maniplré.*
Mato (a large lizard, of the genus Tejus), *iafatoto.*
Media noche (midnight), *fasiyasinarí.*
Menor (younger son), *cadía.*
Mercancias (merchandise), *caguarci.*
Mono (monkey), *püaché.*
Mono blanco (a species of monkey, perhaps Midas œdipus), *aguámí.*
Mono chucuto (another species of monkey, genus Brachyurus), *caroirí.*
Monte (forest), *agüajo.*
Moriche (Mauritia flexuosa, a palm), *teguí.*
Morrocoy (Testudo tabulata, a land-turtle), *curia.*
Muchacho (boy), *macicu-io* (sic!).
Muchachos (boys), *macicu-io* (sic!).
Mujer, mi (my wife), *no-jízo.*
Mujeres, las (the women), *sarii-nai-femí.*
Negro (black), *momoni.*
Nieto (grandchild), *no-ia.*
Onoto (arnatto, Bixa orellana), *oio-maja.*
Oye (hear!), *mesijejatejari.*
Paga (pay), *fide-üena.*
Paja (straw), *ieguarí.*
Palo (tree), *ata.*
Paloma (pigeon), *onoca.*
Papá (father), *nafo.*
Para ti (for thee), *fi-ié.*
Paraguatán (a tree, Macrocnemum tinctoreum), *cafisaná*
Pared (wall), *yaini.*
Pasado mañana (day after tomorrow), *iasanasajiti.*
Pasear à tu casa (to walk to thy house), *monita fijoi.*
Paují (a genus of birds, Crax), *zoita.*
Paují copete (Crax daubentoni), *damoco.*
Paují roncador (another species), *itirí.*
Pava (turkey-hen), *io-cuimani.*
Pavon (a fish, Cichla orinocensis), *cuna.*
Pequeño (small), *juchiji, guichasiája.*
Pereza (sloth), *cia-mo.*
Perico (small parrot), *querequere.*

Perro (dog), *maidi.*
Pez (fish), *jimaa.*
Piapopo (a bird of the genus Rhamphastos), *iocüe.*
Picure (a rodent, a species of Dasyprocta), *gua-ioto.*
Pijiguao (a palm, Guilielma speciosa), *macicuyo.*
Pintado (painted), *sorimení.*
Plátano (plantain, Musa paradisiaca), *faratana* (Span.).
Plato (plate), *farato* (Span.).
Playa (beach, bank of river), *cajasina.*
Poco (little), *juchisimajá.*
Porque (because), *fena.*
Principal horcon (main post of hut), *fotafí.*
Puerta (door), *guaiśi.*
Puntada de cabeza (head ache), *caguinocifo.*
Quiero (I will), *nujateje.*
No quiero (I will not), *fata-nujenanefí.*
Yo te quiero (I love you), *nutateja.*
Qué quieres? (what do you want?), *mesijejatearí.*
Rata (rat), *marijénajatí.*
Ratón (mouse), *atamo*, *acamora.*
Raya (a fish, Trygon hystrix), *yajique.*
Rayado (another fish, Platystoma fasciatum), *coritĺ.*
Regalo, te (I make you a present of . . .), *noregarafí.*
Regalo (a present I make to you), *ie-vale.*
Sal (salt), *io-quira.*
Salvaje (savage), *caiegua.*
Sapo (toad), *tororo.*
Seje (a palm, Œnocarpus bataua), *i-atí.*
Seje chiquito (another palm), *cofetí.*
Tapir (Tapirus americanus), *maciciti.*
Temblador (electric eel, Gymnotus), *samai.*
Tengo, no para tí (I have not for you), *fatafima.*
Terecay (a species of river-turtle, Peltocephalus tracaxa), *sifori.*
Tienes (thou hast), *mefimari.*
Tigre (Felis onça) *cuadiguao-minarí.*
Tierra (earth), *cajachí.*
Tijeras (scissors), *fezí.*
Tinaja (earthen water-vessel), *quanana.*
Titi (a monkey, Chrysothrix sciurea), *vichéce.*
Totuma (calabash), *acuasi.*

Tráeme (bring me), *fitagutane, fifatane.*
Tragavenado (Boa constrictor), *zorema.*
Vámonos (let us go), *üasavaüa.*
Vamos á dormir (let us sleep), *chima üisaüa.*
Vas (you go), *üisajatai-a.*
Váquira (Dicotyles torquatus), *afijija.*
Venado (deer, Cervus sp.), *mataji-o.*
Véndeme (sell me), *fiüendené* (Span. ?).
Vengo (I come), *no-iofiviata.*
Verde (green), *sifotemi.*
Viudita (a monkey, Callithrix torquata), *guacui.*
Voy (I go), *nusafisaji.*
Voy á hacer (I am going to do), *nomafitifiji.*
Vuelvo (I return), *no-io.*
Yema (egg), *inecinaja.*
Zorro (fox), *inarito.*

The Yavitero has many affinities with the Baniva, as pointed out already by Martius, who reprinted a short vocabulary of it collected by Wallace (Wörtersammlung, pp. 261, 262). Montolieu likewise called it a dialect of the Baniva, saying that it differs from the latter principally by the frequent use of the sound *F* in order to form diæresis. The first part of his vocabulary may be found in volume 8 of the *Bibliothèque linguistique américaine*, pages 281 to 284, and this being arranged in Spanish and Yavitero, I have followed the same system, but added to every word its meaning in English and also the scientific names of animals and plants, as far as these are known to me. It is unfortunate that Montolieu appeared to have no idea of which words are most important in making a vocabulary so as to render it useful for ethnographical classification. We may be thankful, however, for what he did.

II. Puinabo.

Agua (water), *eut* (*eu* like *ö*, but very short).
Ahora (now), *da-jo-mat.*
Algodón (cotton), *dé-ju él.*
Anzuelo (fish-hook), *ma-piju.*
Aquí está (here is), *nan.*
Araguato (howling monkey), *ca.*
Así será (well), *jo-tega.*

A ver (let me see), *eglé.*
Barbasco (plant for poisoning fish), *mau.*
Beber (to drink), *bi-vü-ak.*
Bejuco (climbing plant), *i-o.*
Bonito (pretty), *de-jei.*
Buenos dias (good day!), *am-bije-nuk.*
Caña (cane), *chu-chin.*
Caro (dear), *am-bí-bajé.*
Casa (house), *mo.*
Cazabe (cassaba bread), *an.*
Cerro (mountain), *ujel.*
Comer (to eat), *acom.*
Cómo te llamas? (what is your name?), *bamatan.*
Cómprame (buy), *ba-jin-ci-un.*
Cuentas (beads), *ni-e-gap.*
Dame (give me), *acubugan.*
Dividamos (let us divide), *doma.*
Dormir (to sleep), *sogle.*
Está bien (it is well), *ejeí.*
Fuego (fire), *deu* (*eu* = ö).
Hombre (man), *no-si-anté.*
Gracias (thanks), *op.*
Grulla (crane), *tulí.*
Lejos (far), *aijopec.*
Maiz (Indian corn), *cojon.*
Malo (bad), *ejep.*
Mandioca (cassava plant), *masaca.*
Mono (monkey), *cho-o.*
Morrocoy (land-turtle), *i-jue.*
Mujer (woman), *nosomi-ao.*
No (not), *bai-rut.*
Pájaro (bird), *sü-ip.*
Pescado (fish), *yoi.*
Pescado pilado (fish, dried and pounded), *uma.*
Piña (pine-apple), *ijai.*
Plumas (feathers), *sü-ip.*
Plátano (plantain), *t-ta.*
Qué es esto? (what is this?), *indé.*
Te quiero (I love you), *manté.*
Rallo (cassava-grinder), *el-t.*
Rayado (a fish, Platystoma fasciatum), *ijen.*

XUM

Sombrero (hat), *u-ipé.*
Tabaco (tobacco), *jeup.*
Tengo hambre (I am hungry), *am-üi-ric.*
Tú (thou, you), *mam.*
Vagre (a species of fish, Platystoma), *muná.*
Vámonos (let us go), *venoc.*
Vámos á beber yucuta (let us drink yucuta), *am-bon-de-oc.*
Vámos á dormir aquí (let us sleep here), *vi-oi-en.*
Ven acá! (come here!), *nain vai-uc.*
Vénde me! (sell me!), *a-jin-ci-un.*
Ya está! (it is done), *ní-ega-dé.*
Yo (I), *am.*
Zarza (sarsaparilla), *ju-it, tan-peup.*
One, *jai-tun.*
Two, *jaca-jo.*
Three, *jai-pai.*
Four, *jaca-junue.*
Five, *nap-tan.*

The *Puinavis* dwell on the Inírida, an affluent of the Guaviare. Their language appears to be without affinities (Brinton, American Race, 278). A vocabulary of fifty-three words, as collected by Crévaux, is published in volume eight of the *Bibliothèque linguistique américaine* (Paris, 1882), pages 255 and 256. Montolieu's vocabulary contains some sixty words, no more than twelve of which are to be found also in the list formed by Crévaux, viz.:

	Montolieu.	Crévaux.
1. Water	*eut,*	*u, eti.*
2. To drink	*bi-vü-ak,*	*u asioua* (I drink water).
3. To eat	*acom,*	*aynoc.*
4. Maize	*co-jon,*	*cana.*
5. Plaintain	*t-ta,*	*saoua.*
6. Let us go	*ve-noc,*	*bino.*
7. Come here	*nain-vai-uc,*	*maiounani arica.*
8. One	*jai-tun,*	*un, atam.*
9. Two	*jaca-jo,*	*acao.*
10. Three	*jai-pai,*	*apoui.*
11. Four	*jaca-junue,*	*acaouno.*
12. Five	*nap-tan,*	*daptan.*

Of these numbers 1, 6, 7, and the five numerals are evidently the same, with slight phonetic changes.

XUM

III. Piaroa.

The Piaroas dwell on the mouth of the Mataveni, an affluent on the left bank of the Orinoco. Their language appears to be unconnected with any other stock (Brinton, American Race, 266). Dr Crévaux collected a short vocabulary of thirty-seven words, which is published in the eighth volume of the *Bibliothèque linguistique américaine* (Paris, 1882), pages 257 and 258. A more extensive vocabulary was formed by Chaffanjon and inserted in his *L'Orénoque et le Caura* (Paris, 1889), pages 324 to 326. The following list, made by Montolieu, contains some additions to both. The corresponding words from Crévaux and Chaffanjon I have distinguished by the initials Cr. and Ch.

Ají (Capsicum), *aóua ; erate*, Ch.
Anzuelo (fishing hook), *anfuaté ; awache*, Ch.
Araña mono (a large spider, Avicularia blondi), *ajuca*.
Bien (well), *adigua ; adiba*, Cr. ; *adigua*, Ch.
Cabuya (string), *uaraté-zapa*.
Café (coffee), *aijá ; cawe*, Ch.
Camarada (comrade), *camarada* (Spanish).
Canalete (oar), *uadé ; guaiguade*, Ch.
Camisa (shirt), *puñatá ; asca hisata*, Ch.
Candela (fire), *ufcú ; huskuk*, Ch. ; *ocoura*, Cr.
Canto de guerrá (war song), *nanaja*.
Caño (branch of a river), *aje*.
Caña dulce (sugar cane), *majá ; naha*, Ch.
Casaba (cassava bread), *inichi ; ynisi*, Ch.
Cebucan (cassava-press), *añ-na*.
Cerro (mountain), *muijaca ; ynagua*, Ch.
Conversar (to talk), *tryata*.
Copahiba (copaiva), *guaipa*.
Cuchillo (knife), *nauadé ; naguade*, Ch.
Curare (curare, arrow-poison), *manana ; maeneme*, Ch.
Dame (give me), *jit-t*.
Diablo (devil), *anfu-etisa*.
Dia (day), *monó ; morho* (sun), Ch.
Donde (where), *ten-né*.
No entiendo (I do not understand), *enucu-acuese*.
Escopeta (gun), *culupa ; cuhupe*, Ch. (Span. *chopo*).
Escucho (I listen), *enucu* (= I understand).

Espejo (looking-glass), *tejatoba; tijata*, Ch.
Feo (ugly), *suraja*.
Hablo (I speak), *jucua-cua*.
Hablas (you speak), *jucua-ta*.
Hombre (man), *jumeto; ovo*, Ch.
Grande (large), *eninajé; buio*, Ch.
Luna (moon), *camuja; chawa*, Ch.
Machete (cutlas), *ureda; curoode*, Ch.
Maduro (ripe), *itzu*.
Malo (bad), *chura; suraa hiso* (very bad), Ch.
Marima (the inner bark of a species of Lecythis, used as cloth), *duta*.
Mujer (woman), *naté; isaho*, Ch.
Niña (girl), *pujate; chistiho*, Ch.
Noche (night), *iodó*.
Nosotros (we), *u-uoto*.
Oro (gold), *corao*.
Pequeño (small), *piquin-dian; ykia*, Ch.
Periquito (a small parrot), *muéké*.
Piapoco (a bird, Rhamphastos sp.), *pubí*.
Plátano (plantain), *baruru; paruro*, Ch.
Puerto (port, landing), *tabuara*.
Rio (river), *paragua*.
Ron (rum), *niña-ja-ia* (*ahiia*, water, Cr.).
Sol (sun), *mono canuja; morho*, Ch.
Sombrero (hat), *cadi-uca; kyuhak*, Ch.
Tabaco (tobacco), *ja-jet-né; haté*, Cr.; *haatei*, Ch.
Tinaja (water-vessel), *cañári*.
Totuma (calabash), *baraj; mukiriba*, Ch.; *mourica*, Cr.
Tú (thou, you), *u-cu*.
Véndeme (sell me), *i-it*.
Vosotros (you, pl.), *u-cutu*.
Yeso blanco (white plaster, gypsum), *erédaca*.
Yo (I), *T-ten*.

SOME PHRASES.

Vamos á dormir (let us go to sleep), *peneta-já*.
Vamos á comer (let us eat), *chiratucua; chuscua* (to eat), Ch.*
Vámonos (let us go), *taratimua*.
Ven acá (come here!), *ichi-ua; thivaa*, Ch.

*Cfr. the Chibcha *bsoscua*, to eat.

NUMERALS.

1, *nanté.*
2, *tajo.*
3, *uameta.*
4, *imuté.*
5, *imoterua.*
6, *caramuté nanté* (5 + 1).
7, *caramuté tajo* (5 + 2).
8, *caramuté uameta* (5 + 3).
9, *tanmoredué.*
10, *tanmoredé.*

CLAY FIGURES FOUND IN GUATEMALA

BY P. J. J. VALENTINI

The last Quarterly of Publications of the Royal Ethnologic Museum, Berlin, volume IV, 1, contains the result of certain explorations made by Dr Ch. Lapper in the Central American provinces of Chiapas and Guatemala. The traveler calls attention to the vast amount of hitherto unknown Indian settlements lying in ruins on that ancient culture-ground. Although devoid of the architectural grandeur and the sculptural finish exhibited in the palatial ruins of Chichen Itza, Copan, and Palenque, the author says that they nevertheless must not be overlooked by future explorers. At the slightest scraping of the surface they yielded a crop of interesting relics, principally of pottery, and when viewed as a whole they revealed the fact that in culture the people seem not to have been so absolutely dependent on those larger centers as was believed; for each of the now collapsed group of structures still exhibits that main feature of worship, the sacrificial tumulus with its platform on top and steep staircases subtending often an angle of eighty degrees. In plan, however, the construction appears to conform to their more sumptuous models, the precincts and the oblong edifices enclosing inner yards, and these yards lying deeper than the common level. Dr Lapper found no mortar employed either in the slabs that covered the tumuli or in such walls as were built to fortify the places and to make them inaccessible to the enemy. The explorer cites not less than seventy-one of such places, extending from central Chiapas to the confines of Honduras and Guatemala. They are shown on a chart, and views and measurements of twenty of them also illustrate the text. Those shown on plan 20, representing the ruins of Socabaja (department of Quiche, Guatemala), are reported by Dr Lapper as of larger extent and of more interest than all the others he succeeded in exploring.

One part of the pottery collected on this tour was presented by the explorer to the Berlin Ethnologic Museum, and carefully described and commented upon by Dr Ed. Seler, the curator of

the American department, in sequence to Dr Lapper's article, pages 21–53. Dr Seler's text, as usual, is full of additional historical information and of suggestive generalizations, proving again how much he is at home in a district more than three thousand miles distant from his own.

Among the one hundred and four illustrations given three attracted our special attention. They represent figures of clay, pertaining to the Sarg collection, which was made on the ground explored by Dr Lapper, and which are quoted for the purpose of certain comparisons. We regret that Dr Seler should not have dwelt a little longer on these curious specimens; possibly he abstained because they have been discussed elsewhere, a fact, however, which has not come to our knowledge. We reproduce those specimens in Figs. I, II, and III, adding thereto a few remarks.

Figure I.

Although the specimens were acquired in Coban (Verapaz), we doubt if they were the product of the tribe of Indians living in this department. They seem to us to be imported. They are of an execution too nice, too individual, quite too artistic, and deviate too much from the conventional pattern exhibited in the pottery manufactured by the Indians of the Guatemala-Altos to be modeled by their hands. Judging from the features of Fig. III, it is evident that this head is not that of an Indian; it shows neither the characteristics of prominent cheek-bones nor the usual decoration of plumed head-dress and earrings. We believe it to be the portrait of a Spaniard—the faithful reproduction of the visage of one of those stern and haughty "capitanes" who mercilessly made themselves masters of person and property and rulers of the soil

they trod. We notice the characteristics of the short-cropped hair, the deep-cut folds above the nose, which is strong but sharply modeled; the energetic mouth, whose upper lip is covered with a moustache trimmed by scissors, and which, in expectation of his "portrait being taken," seems carefully waxed and trimmed at both ends.

We do not venture to state from what part of conquered Central America this image of one of the Castilian "bravoes" has found its way to Coban, where it was obtained by Mr Sarg. What we wish to emphasize is that this head cannot possibly be viewed as belonging to the indigenous race, and can hardly have been manufactured on the place or neighborhood where it was obtained. It may be remembered, in this connection, that by solemn contract made with the chieftains of the Verapaz, white men, save the few missionaries appointed by the bishop of Guatemala to convert the natives, were forbidden to visit this province. It is but thirty years since that the Indians of the Verapaz have permitted white men to settle among them.

Figure II.

As regards Figs. I and II we also think these clay relics must be considered as being imported to the Verapaz; there is no doubt, however, that they represent specimens of an Indian race. This fact is plainly warranted at first sight by the peculiar cut of the hair, the pearl string around the neck, the scanty shirt, and the large ear-plates. That the latter are square and not round, as they are usually represented throughout Mexico and the whole of Central America, in sculpture as well as in painting, is a fact so exceptional that it must strike the eye of every student conversant with the matter.

The clay figure (I) shows a plump little woman sustaining the weight of a large water vessel on her shoulders. We imagine her having gone down to the brook to fill it, and that trying to lift the heavy vessel she found the task to be too hard for her. So she broke down, musing what to do with her own self and what with that vexatious burden. Her helplessness is marvelously well

expressed, and must have been caught in the act itself by the watchful eye of one of the tribal artists, who really executed a little masterpiece when he made her leer angrily toward the cruel foe that keeps her pressed to the ground, and at the same time contrasted her feeling of despair with that of self-ridicule, expressed in the laughter of the upturned lips. This highest apex of art—to depict in the position of the body, and in the facial lineaments any predominant or mixed feeling, such as would stir the muscles of the human face under the impulse of a certain momentary impression—is never seen in any product of Indian hand from Puget sound down to Patagonia. The only exception we know of is that of the Chiriquian potter-artist. Through his work in this line, as shown in excavated specimens, we feel almost compelled to say that the Chiriquian Indian shows himself the only one of the many races of the whole continent who knew mirth and merriment, and who did not deem it beneath his dignity to reproduce these sentiments in his much-beloved clay. Now, we are far from venturing the conjecture that our little statuette was imported from the Isthmian straits to the Altos of Guatemala. What we conjecture is only this: that it was the product of the hands and of the mirthful bent of mind of those Chiriquian invaders, of whom we read in Burgoa that they had come sailing in canoes from Nicaragua and farther south to land in Tehuantepec, taking possession of the islands and waging a long war against the Zapotecas, by whom they finally were absorbed. The same way, we know, had also come the Mangues, only that this tribe succeeded in taking permanent hold of Chiapas. Therefore it would not be preposterous to assume that some families of those straggling *Wabi*, as they were called by the Zapoteca, or *Cueva* and *Coïba*, as the Isthmian Conquistadores called them, had kept up their independence as well as their hereditary talent in the country of their adoption. The Chiriquians we know of wore no square ear-plates or any ear-dress at all, but, having settled among the gorgeous Zapoteca, they may have adopted the fashion, only that they chose or were forced, for the sake of

Figure III.

individuality, to shape them otherwise; also the straight forehead, the rounded fat face, and the full sensual lips (Fig. III) speak of a race distinct from that among which they had come to live.

We leave it to the expert to refute or confirm the conjectures we have hazarded concerning these clay figures from Coban.

OBITUARY

James Constantine Pilling

The scholarly article on the writings of Padre Andres de Olmos on pages 43–60 of this volume was the last notable publication of James Constantine Pilling, bibliographer and administrative officer; he died July 26, 1895, of locomotor ataxia, from which he had been a constant sufferer for years.

Despite a painful and hopeless malady, Mr Pilling was an industrious, prolific, and erudite student of literature relating to the native American languages. During 1894 he put through the Government press a bibliography of the Wakashan languages; in 1893 he issued a bibliography of the Salishan languages and a bibliography of the Chinookan languages (including the Chinook jargon); during the next preceding year his bibliography of the Athapascan languages was prepared and issued; in 1891 he prepared and revised the most extended of his bibliographies, that relating to the Algonquian languages, a volume of 625 pages, illustrated by facsimiles of titles of rare works; in 1889 his bibliography of the Muskhogean languages was published, and during the preceding year that of the Iroquoian languages was made ready to leave the press; in 1887 the bibliographies of the Siouan and Eskimo languages were issued. These nine volumes are a rich store of knowledge pertaining to American ethnology; the work is primarily linguistic, yet the mode of treatment is such that practically all of the more valuable early literature of the American Indians is listed and described. The series represents the fruition of the plan for a bibliography of the languages of the North American Indians set forth in a quarto volume of nearly 1,200 pages by the same author, issued in the form of proof-sheets in 1885. This bibliographic work was projected by Major J. W. Powell,

and Mr Pilling was placed in charge of it on account of his learning, accuracy, and literary ability. No class of the scientific publications of the Government has been received with greater favor by scholars; wherever anthropology is cultivated throughout the world, there Pilling's bibliographies are known.

For several years Mr Pilling was chief clerk of the Bureau of American Ethnology, and also of the United States Geological Survey, and much of his bibliographic material was accumulated while he was engaged in the performance of the arduous duties attending these offices. His faculties were such that he was able to carry forward the literary work without prejudice to his administrative duties, which were performed with noteworthy ability and judgment; indeed, no inconsiderable part of the success of the two bureaus is to be ascribed to his skill, tact, and energy in administrative work.

In early manhood Mr Pilling came in contact with Major Powell, whom he accompanied into the field and by whom his bent of mind and subsequent career were measurably determined. His interest in Indians and in linguistics grew out of this association. He had already made himself a stenographer of exceptional skill, and had acquired literary knowledge through employment in a book store. His education, begun in the public schools of Washington, was perfected in Gonzaga College. He was born in Washington November 16, 1846.

In the world of letters James Constantine Pilling was and will be known as a bibliographer of notable acumen and erudition; in the Federal capital he was most widely known as an upright and courteous administrative officer. Among his more intimate acquaintances at home and abroad he is remembered as a man of exceptional integrity and amiability. Powell, who knew him long and intimately, says: "In all my life I have never known a man more steadfast to his moral and intellectual convictions, which were held with that charity for others which is possible only to those who have strong and well-founded convictions of their own." His official associates, joining in an expression of sorrow on receiving the intelligence of his death, said: "In recalling our associations with him we recollect no discourteous act or word, even when the burden of duty pressed most heavily; we recollect no selfish or narrow decision; on exchanging ideas

we all, without exception, agree that we have known no man of higher integrity or better motives. His administrative work was a model, and its results in the bureaus with which he was connected constitute a monument."

Mr Pilling left a consort, to whose tireless solicitude through years of painful decline the completion of so much of his work is due, and a young daughter.

W J McGee.

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